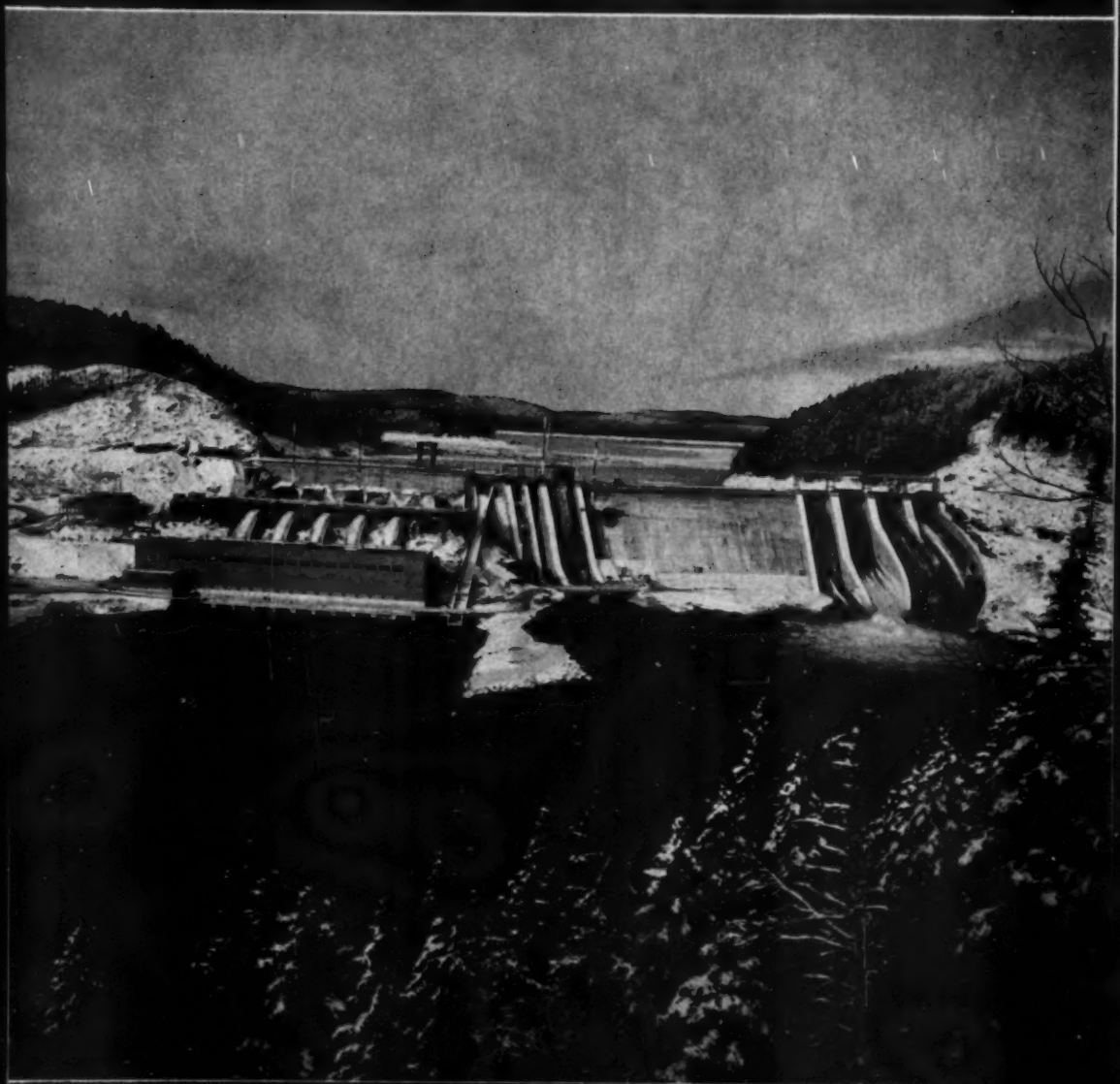
INDUSTRY AND POWER



User Reports

ARMSTRONG "UNIT TRAPPING"

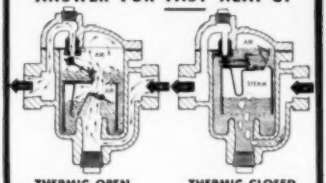
cut his fuel bill

20%

and speeded heat-up

15%

"BLAST" TRAPS PROVE TO BE ANSWER FOR FAST HEAT-UP



THERMIC OPEN THERMIC CLOSED

Where steam is turned on and off periodically, blast traps give really fast heat-up, provided accumulated air and condensate is pocketed and will be pushed out ahead of incoming steam. A large auxiliary thermic vent in the bucket opens when the trap is cold, letting air whistle right through trap. When trap reaches 210° F the thermic vent closes and trap operates as a standard trap (see drawings above). Blast traps are ideal for single pipe coils, small on-and-off unit heaters, on-and-off multiple coils, drip points, etc. See page 39 of The Steam Trap Book.

Experience of Greenhouse Owner Points Way to Greater Efficiency in Any Plant . . .

THE problem of operating steam heated equipment efficiently is basically the same whether you operate a greenhouse, a refinery or a food processing plant. That is why the experience of Reiss' Greenhouses, Minneapolis, should prove of interest and value to you.

By replacing old, inefficient steam traps on heating piping with an individual Armstrong "blast" trap on each coil, Reiss' cut its fuel bill exactly 20% and speeded-up heating of cold coils by 15%.

This benefit was gained solely because Armstrong traps drain condensate and air from steam heated units as fast as it accumulates and without leaking steam. In Reiss' case the "blast" traps described at the left were particularly beneficial, and may be in your case. For complete information call your local Armstrong Representative, or write:

ARMSTRONG MACHINE WORKS
820 Maple Street, Three Rivers, Michigan

See Our Exhibit National Power Show, Grand Central Palace, New York, December 1-6

You Get More Out of Your Fuel When You Use Armstrong "Unit Trapping"

SEND FOR YOUR FREE COPY OF THE 44-PAGE ARMSTRONG STEAM TRAP BOOK!

Complete data on selection of traps for all types of equipment plus installation and maintenance recommendations, trap list prices and physical data.

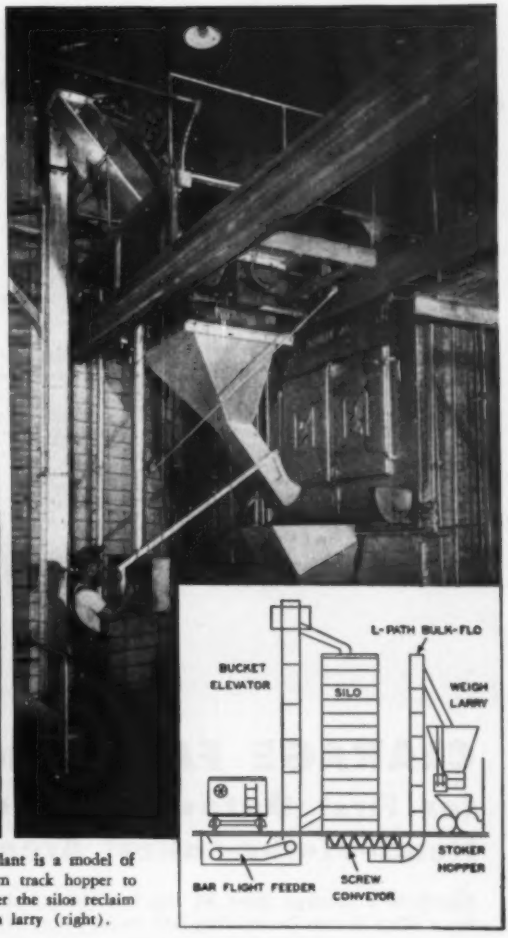
JUST CLIP THIS TO YOUR COMPANY LETTERHEAD AND MAIL:

ARMSTRONG MACHINE WORKS
820 Maple Sreet, Three Rivers, Michigan

Please send me The Steam Trap Book.

Name_____

Title_____



This Link-Belt coal handling system in an industrial power plant is a model of compactness and efficiency. Bar flight feeder moves coal from track hopper to bucket elevator feeding two silos (left). Screw conveyors under the silos reclaim to L-type Bulk-Flo Conveyor-Elevator, which delivers to weigh larry (right).

Sure way to cut power plant costs . . . start with efficient coal handling

No two power plants have exactly the same operating requirements or physical limitations. That's why Link-Belt's broad experience in designing and building coal handling systems offers you unique advantages.

Consider, too, the completeness of the Link-Belt line. Our engineers can choose from all types and sizes of equipment for unloading, storing, handling and weighing your coal. And Link-Belt will assume complete responsibility for the entire installation—from planning to erection, if desired.

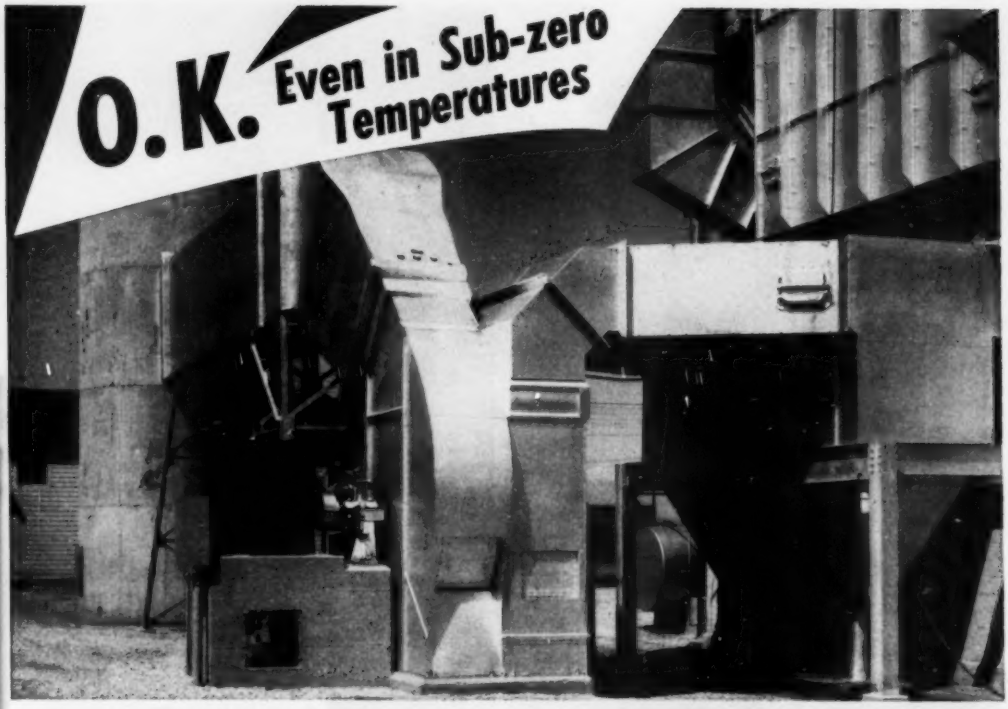
New Book 2410 shows latest equipment and system layouts for power plants large and small. Ask your nearest Link-Belt office for a copy. You may find some ideas that will help cut your coal handling costs.

LINK-BELT

COAL HANDLING EQUIPMENT

LINK-BELT COMPANY Plants: Chicago, Indianapolis, Philadelphia, Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices in Principal Cities. 12.301

O.K. Even in Sub-zero Temperatures



CLARAGE FANS Selected for First Outdoor Station in Head-of-the-Lakes' Area

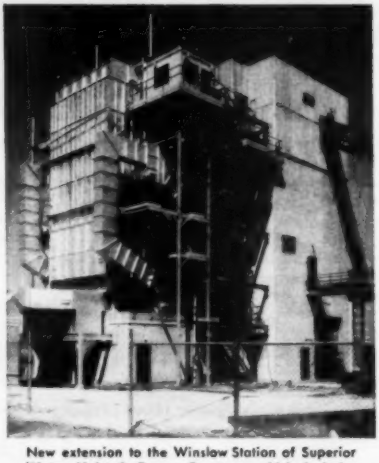
Above is a Clarage Type RT Fan furnishing induced draft for a Riley Steam Generating Unit in Superior, Wisconsin — a recently completed 12,650 KW extension to the Winslow Station of the Superior Water Light & Power Company. Forced draft is also supplied by Clarage.

Here is a completely outdoor installation located where winter temperatures of 30 to 40 degrees below zero are not exceptional. **Unprotected equipment to function properly in such a rigorous climate must be good!**

Through past experience Ebasco Services, Inc. (the consulting engineers), Riley Stoker Corporation, and this great public utility KNEW that they could depend on Clarage fans — and time will prove that their choice was well founded.

Yes, regardless of operating conditions, you can RELY on CLARAGE to provide economical performance for a long time to come.

CLARAGE FAN COMPANY, 635 PORTER, KALAMAZOO, MICH.



New extension to the Winslow Station of Superior Water Light & Power Company which includes steam temperature control, water-cooled furnace and steel-clad instrument setting.

You can Rely on...

CLARAGE

Headquarters for Air Handling and Conditioning Equipment

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA Canada Fans, Ltd., 4285 Richelieu St., Montreal

Edited specifically for executives and engineers responsible for the selection, installation, operation & maintenance of equipment required for Engineered Plant Services*

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*By ***Engineered Plant Services*** we mean the ***providing*** or ***generating, transmitting, controlling, applying,*** and ***maintaining*** of POWER, STEAM, MECHANICAL DRIVES, HEAT, ELECTRICITY, AIR, WATER, and other engineered services in and for all areas of the industrial operation. This includes Lubrication, Piping Systems, Industrial Waste Disposal, Corrosion Control, Electrical Systems, Industrial Heat, Coal and Bulk Handling, Dust and Fume Control, and other related services of an engineering nature.

INDUSTRY AND POWER

The Magazine for Engineered Plant Services

VOLUME 63 **NOVEMBER 1952** NUMBER 5

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Acorns of science

Developments not yet available, but of interest to those responsible for Engineered Plant Services

Simpler Electronic Counters

● Working to reduce present complicated high speed electronic counters to a simple, one tube unit with low power consumption, which could be advantageous in automatic control, Signal Corps scientists have explored and reported on fundamental data involved in shifting glow discharges from one electrode to another at high speed. Included in the report is a design for small, lightweight tubes for counting rates up to 100,000 per sec, with an indicated life of 20,000 hr and power consumption 1/16 that of present counters of comparable speed.

Analysis by Ion Exchange

● Developments in resins have resulted in an analytical tool that may be used for determining ionic concentrations of boiler waters, water hardness, pH, and other procedures involving electrolytes, as well as determining amount of water in alcohol solutions. As reported by The Permutit Company, small dry resin particles, 0.02 in. in diameter, swell 25 to 50 times when placed in water. When in contact with electrolytes, the volume changes, the amount depending on concentration and type of ions. The change may be measured in a small column in a tube, or with a single particle by microscope. The particles swell and contract reversibly, have been used for fifteen consecutive tests.

Ion Exclusion

● Another advance for ion exchange resins, a process developed by Dow Chemical Company is expected to produce economies in removal of acids, salts and bases. Non-ionic substances are separated from ionic substances in solution by passing the solution through a bed of ion exchange resins. The process, however, differs from ion exchange in that the rinse water used in ion exclusion regenerates the resin for re-use, avoiding other chemicals.

High Temperature Insulator

● Marked interest currently surrounds use of boron nitride, first marketed in 1950, as an electrical insulator at high temperature. New techniques announced by the Norton Company make molded plates, cylinders, rings and other shapes available and bring prices down. Resistivity is high at all temperatures, the powder is not heated by high frequency induction up to 2400 C, and melting point is 3000 C. The powder is also used as an anti-sticking agent for molding glass or metal, and as a heat resistant lubricant, alone or in a selected vehicle.

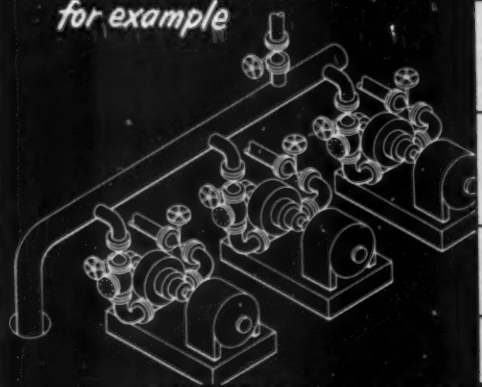
Patents on Flow Control

● No. 2,606,573 covers a new and improved flow control indicator assembly for widely variable fluid flow conditions. The apparatus comprises in part an adjustable Venturi tube in combination with a universal flow indicator.

No. 2,610,300 describes an improved means for automatically controlling vapor flow to a mass spectrometer, including means responsive to changes in vapor content in the spectrometer chamber for altering the balance in a bridge network to produce signals which, by other means, operate a valve.

Can You Trust Your Checks to Hold Like This?

. . . on Water Pumps, for example



THE INSTALLATION

Crane Iron Body Swing Check Valves in 8-inch vertical lines on discharge side of water pumps supplying a large eastern paper mill.

VALVE SERVICE RATINGS

SUITABILITY: Working smoothly - no complaints

FEATURES: O.K. for either horizontal or upward flow

MAINTENANCE COST: None - no maintenance needed to date

SERVICE LIFE: Now better than other checks used

OPERATING RESULTS: No water or head loss

PRICE: In line with other makes

AVAILABILITY: Stock item - Crane product

THE HISTORY

The mill depends on these pumps for all water. Loss of head at the pumps would create a serious problem. The mill could take no such risks. Regularly, the check valves on pumps were replaced, but only to be found leaking between pumping cycles, a few months later.

It's now more than a year since the change-over was made to Crane Check Valves. There's been no loss of water, no maintenance or replacement of any checks on the pumps. That was proof enough for the mill, that Crane Quality means better valves —greater dependability and bigger value. As a result, 3 more of these checks were installed on a separate battery of suction pumps.

THE VALVE

Crane No. 373, 125-Pound Iron Body Swing Check Valves, brass trimmed. The long life and high seating efficiency of these checks, in 2 to 8-in. sizes, is in large part due to the Crane patented flexible disc-hinge design. Double spring mounting eliminates lost motion between parts, yet permits true, full contact of disc and seat at every closure. Also serves to absorb the shock of seating under backflow pressure. See your Crane Catalog or Crane Representative for full details.

The Complete Crane Line Meets All Valve Needs. That's Why

More Crane Valves Are Used Than Any Other Make!

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CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois

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VALVES • FITTINGS • PIPE • PLUMBING • HEATING

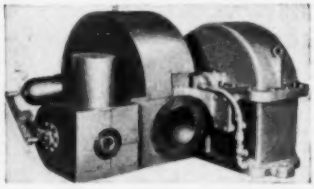
New equipment and developments

Highlights of new products by leading manufacturers

Each new product item has a key number for your convenience in asking for additional, detailed information. Insert key number on return post card on page 147

1—Reduction gears are for high speed

High speed reduction gears for mechanical drive turbines, developed by Elliott Co., are available in built-in or coupled designs. The former design



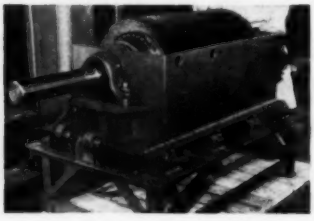
includes turbine and gear case secured together with turbine wheels and pinion mounted on the same shaft. The coupled design is a self-contained unit which is flexibly coupled to a separate turbine drive. Ratios are up to 5:1 for built-in units and to 8.5:1 for the coupled design. Construction is described in an 8-page bulletin.

2—Relay provides end point control

End point temperature control for processes requiring automatic shutdowns and manual resetting is provided by a cut-off relay developed by Minneapolis-Honeywell's Industrial Div. It operates with an electric temperature or pressure controller and a solenoid or motor-operated valve. Capacity is 13 amp at 115 v and 6.5 amp at 230 v.

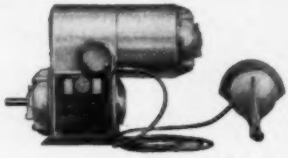
3—Brushing unit cleans conveyer belts

To prevent residue from building up on conveyer belts and return rolls, The Osborne Manufacturing Co. has developed a brushing unit to continuously clean the belt. It consists of a 12 in. diam brush mounted in suitable bearings and coupled to a gear head motor. Adequate provisions are provided to guide brushed off material away from the belt.



4—Variable speed motor features remote control

U. S. Electrical Motors Inc. has developed a fractional horsepower variable speed motor, Varidrive type 5 VA, having a mechanical remote control. A flexible cable permits the control handwheel and indicator dial to be located away from the unit so that a machine



operator can control speed without going to the motor. Units are available in ¼, ⅓, ½ and ¾ hp with speed ratios up to 10 to 1 over a range of 4 to 10,000 rpm. Literature is available.

5—Temperature controller provides flexibility

Precision temperature control is provided by a portable instrument developed by Taco West Corp. In operation, the equipment to be controlled is

plugged into the Gardsman controller, which operates from a wall outlet, and a thermocouple is inserted into the oven, bath or well. The unit, which indicates and controls, is available for either high limit or on-off control. Dual scale ranges are for 50 to 500 and 0 to 2000 F.

6—Plastic tape is for pipe wrapping

Anti-corrosion qualities of poly-vinyl chloride and ease of applying pressure sensitive tape are combined in a tape developed for pipe wrapping by Minnesota Mining and Manufacturing Co. Said to eliminate the need for such cumbersome equipment as tar pots, it provides an economical pinhole-free

coating which can be applied in the field. Two thicknesses, 10 and 20 mils, are designated Nos. 50 and 51 respectively. Lengths of 100 ft are available with widths of 1, 2, 4, 6, 8 and 12 in. An 8-page bulletin lists data required for use.

7—Motorized sweeper cuts maintenance costs

With the use of an improved motorized sweeper, industrial sweeping can be accomplished in a fraction of the time required by the push broom method, according to the manufacturer, Multi-Clean Products, Inc. A rotary brush sweeper and heavy duty vacuum cleaner are combined to form an integral unit. A 1½-2 hp air-cooled gaso-

line engine furnishes power. The unit picks up such materials as dust, dirt, small metal parts and shavings.

(Continued on page 10)

JENKINS PRACTICAL PIPING LAYOUTS 63

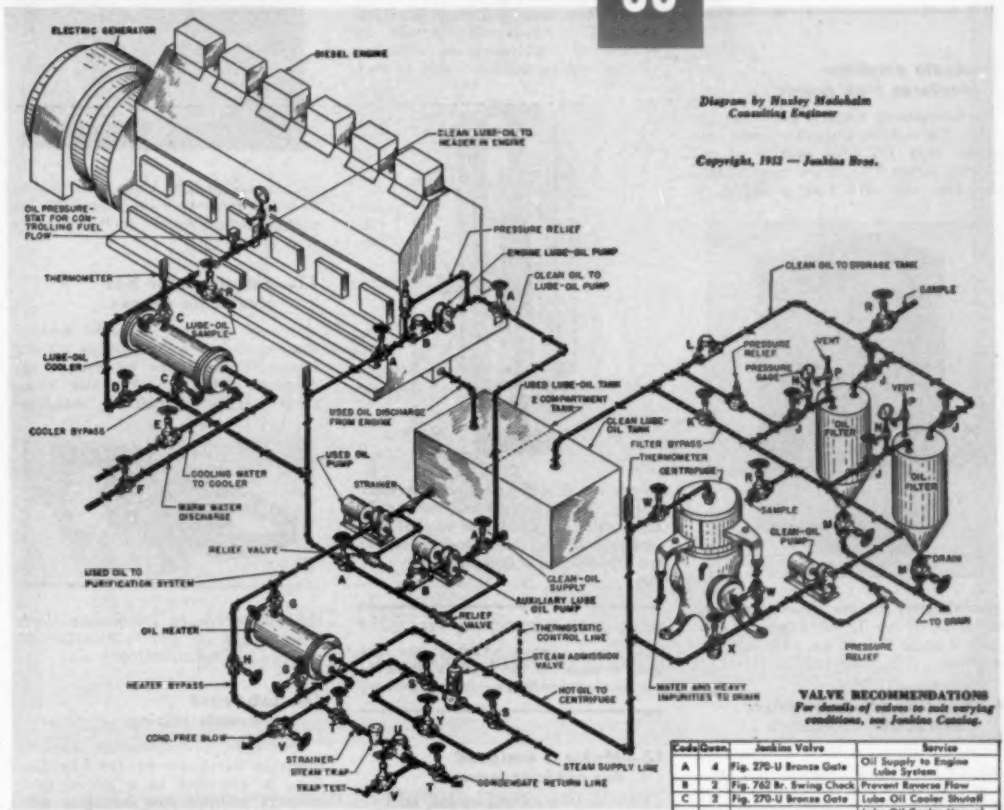


Diagram by Wesley Hedeholm Consulting Engineer

Copyright, 1952 — Jenkins Bros.

VALVE RECOMMENDATIONS
For details of valves to suit varying conditions, see Jenkins Catalog.

Code	Quan.	Jenkins Valve	Service
A	4	Fig. 270-U Bronze Gate	Oil Supply to Engine Lube System
B	2	Fig. 762 Br. Swing Check	Prevent Reverse Flow
C	2	Fig. 270-U Bronze Gate	Lube Oil Cooler Shutoff
D	1	Fig. 270-U Bronze Gate	Lube Oil Cooler Manual Bypass
E	1	Fig. 950 Bronze Globe	Cool Water Supply to Lube Oil Cooler
F	1	Fig. 270-U Bronze Gate	Water Discharge Shutoff
G	2	Fig. 270-U Bronze Gate	Oil Heater Shutoff
H	1	Fig. 270-U Bronze Gate	Oil Heater Manual Bypass
J	4	Fig. 270-U Bronze Gate	Oil Filter Shutoffs
K	1	Fig. 270-U Bronze Gate	Oil Filter Manual Bypass
L	1	Fig. 762 Br. Swing Check	Prevent Reverse Flow
M	2	Fig. 930 Bronze Globe	Filter Drains
N	3	Fig. 743-G Br. Needle	Pressure Gage Control
P	2	Fig. 930 Bronze Globe	Filter Air Vents
R	3	Fig. 950 Bronze Globe	Oil Sampling Take Offs
S	2	Fig. 270-U Bronze Gate	Steam Supply to Oil Heater
T	2	Fig. 270-U Bronze Gate	Condensate Shutoffs
U	1	Fig. 762 Br. Swing Check	Prevent Condensate Backflow
V	2	Fig. 950 Bronze Globe	Condensate Bypasses Free Blow Trap Test
W	2	Fig. 270-U Bronze Gate	Centrifugal Shutoff
X	1	Fig. 270-U Bronze Gate	Centrifugal Bypass
Y	1	Fig. 936 Bronze Globe	Bypass on Automatic Steam Valve

How to plan a LUBRICATION OIL PURIFYING SYSTEM FOR DIESEL ENGINES

Lubrication oil purification systems are used on practically all modern diesel engines to assure longer oil life and decreased engine maintenance. Purification, however, must be accomplished without removing beneficial oil additives which increase lubricant efficiency and preserve bearing surfaces.

The diagram above shows a typical lubrication oil purification system designed to meet diesel engine needs. Circulated oil from the engine is returned to a tank and part or all of it is pumped through a heater. Here, it is raised to optimum cleaning temperatures. A centrifuge then removes water and impurities. The partially cleaned oil next passes through filters, where light impurities and colloidal carbon are removed.

In normal operation of the diesel, the lube-oil enters a clean oil storage tank, after which it is pumped back to the engine through a cooler, generally a shell and tube heat exchanger with water as the coolant, which reduces oil temperature raised during purification.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installations.

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering, select all the valves you need from the complete Jenkins line. It's your best assurance of *lowest cost in the long run*. Jenkins Bros., 100 Park Ave., New York 17.

Complete description and enlarged diagram of this layout free on request. Includes additional detailed information. Simply ask for Piping Layout No. 63.

JENKINS VALVES
LOOK FOR THE DIAMOND MARK
SINCE 1864
Jenkins Bros

New equipment and developments

(Continued from page 8)

8—Audio amplifier features high power

Westinghouse Electric Corp. has developed a variable frequency audio amplifier, type FG 5/10, capable of delivering either 5 or 10 kw output power. The unit will take a signal of

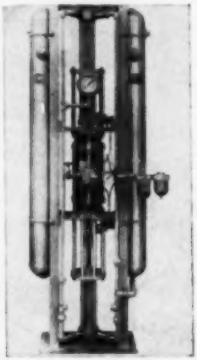
approximately 10 mw from any conventional 30 to 10,000 c source and build it up to 5 or 10 kw with uniform response.

9—Flooring product resists destructive chemicals

Latex-O-crete, a floor coating developed by United Laboratories, Inc., is said to resist the destructive action of chemicals. The product can be applied to an old surface, either interior or exterior, without special treatment other than cleaning. The product is said not to contain bituminous materials. Literature listing applications is available.

11—Hydraulic power unit uses low pressure air

High fluid pressures are developed from low pressure plant air supply by heavy duty, air-hydraulic pumps and power units made by Ledeen Manufacturing Co. Applications include operation of high pressure cylinders, clamps, valves, actuators and hydrau-



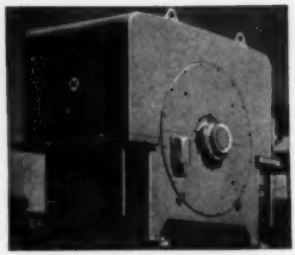
lic presses as well as for high pressure testing. Both pressure and volume are adjustable. Horizontal or vertical construction is available. Design features are discussed in a bulletin.

TO REQUEST ADDITIONAL FREE DATA

Insert "key" numbers on return post card found on page 147. Our Reader's Service Department will handle your request promptly

12—Motor is designed for outdoor service

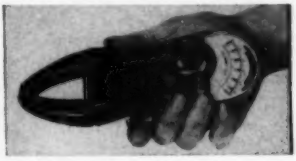
For use in semioutdoor and outdoor steam electric stations, Allis-Chalmers Manufacturing Co. has developed an outdoor weather-protected motor designed to keep wind driven heavy moisture out of the windings. It is said to offer greater protection than the



splashproof design. Units are available in a full range of ratings required for major auxiliary drives, including boiler feed pumps.

13—Volt-ammeter has nine scale ranges

Current can be measured without shutting down equipment or making ammeter connections by use of the Amprobe 300, a pocket size snap-around type volt-ammeter manufac-



tured by Pyramid Instrument Corp. Scale ranges are 0-6/15/30/60/150/300 amp a-c and 0-150/300/600 v a-c.

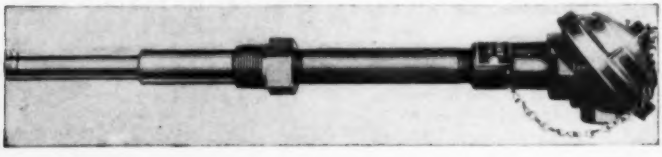
14—Lubricant prevents seizing

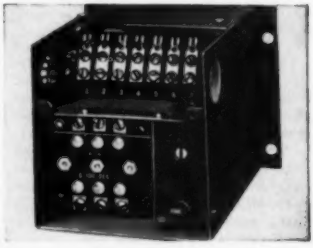
Anti-Seize, a molybdenum disulfide lubricant developed by Bel-Ray Co., Inc., is described as a stable, nonmelting, multi-purpose lubricant with an unusual capacity to prevent seizing and galling at bearing pressures over 100,000 psi. It is said to lubricate from below zero temperatures up to 750 F.

(Continued on page 14)

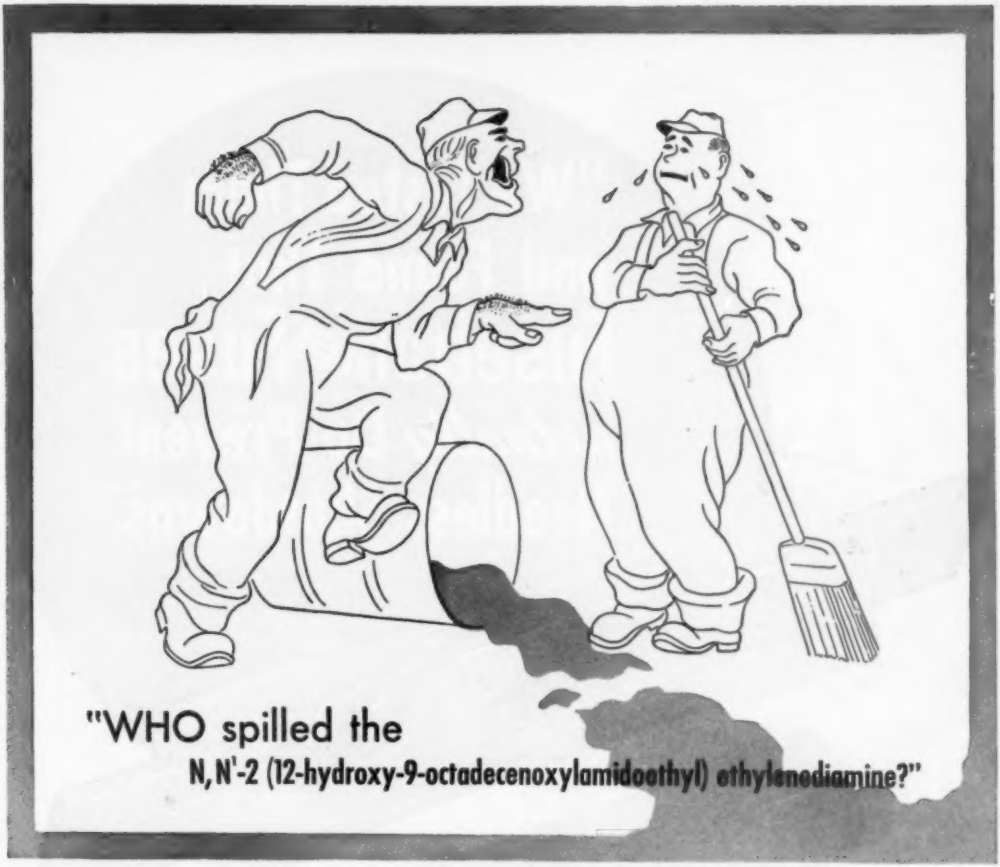
10—Temperature transmitter is for electronic control

Applications in chemical and food processing plants, refineries and central stations are listed for the type T2T Autronic temperature transmitter developed by The Swartwout Co. The unit, designed primarily for use with the Autronic control system, consists essentially of a resistance thermometer element and thermometer adapter unit. Various thermowell styles are available for the thermometer element. The adapter unit, which converts resistance changes in the thermometer element to a proportional signal voltage, is avail-





able with numerous temperature ranges and spans in either centigrade or fahrenheit. Data are available.



LET'S put it this way: WHO SPILLED THE NALCO ANTIFOAM? Either way . . . N, N¹-2 (12-hydroxy-9-octadecenoxylamidoethyl) ethylenediamine, or Nalco Antifoam . . . this foam control material is powerfully effective. It is one of several Nalco antifoams that are widely used, not only in boilers, but wherever foaming liquids are a problem.

Nowadays the language of the water treating industry could be full of confusing technical terms . . . like this chemical description of a Nalco antifoam. Translation to common, understandable terms is one of the jobs of your Nalco Representative. You can count on him for an honest appraisal of your problem and a simple, unconfusing recommendation for its solution.

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"This is Nalco"

This picture story of Nalco will acquaint you with the research and production facilities available to solve your water treating problems. Write for your free copy today.

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"We Tested Them and Found That Fusetron (DUAL ELEMENT) Fuses *actually* Do Prevent Needless Shutdowns"

You too can profit by Mr. Walker's Experience

By taking advantage of the 10 POINT PROTECTION of FUSETRON Dual-Element Fuses

1 *Protect against short-circuits.

2 Protect against needless blows caused by harmless overloads.

3 Protect against needless blows caused by excessive heating — lesser resistance results in cooler operation.

4 Provide thermal protection — for panels and switches against damage from heating due to poor contact.

5 Protect motors against burnout from overloading.

6 Protect motors against burnout due to single phasing.

7 Give DOUBLE burnout protection to large motors — without extra cost.

8 Make protection of small motors simple and inexpensive.

9 Protect against waste of space and money — permit use of proper size switches and panels.

10 Protect coils, transformers and solenoids against burnout.

*Fusetron Fuses have high interrupting capacity as shown by tests of the Electrical Testing Laboratories of New York City in December 1947.

"We have a 3 phase, 3 circuit switch panel controlling a resistance type heat treating furnace. In this switch we formerly installed nine 600 amp. 250 volt renewable fuses.

"These fuses, however, heated excessively and were blowing as often as once a day. To stop these blows we even tried out using 800 ampere links but it didn't do any good. We still had fuses blowing.

"As a test we installed three 600 amp. Fusetron Fuses in one circuit. That was in May, 1947.

"The first and only blow we had on these Fusetron fuses was in April 1948—one year later. This blow was apparently caused by the heating of the ordinary fuses in the other two circuits.

"The shutdown caused by this blown Fusetron fuse woke us up to the fact that the test we had made proved that Fusetron dual-element fuses actually do prevent needless shutdowns.

"Since then we have used only Fusetron fuses in this switch and our needless shutdown troubles have disappeared."

H. T. Walker, *Chief Electrician*
Cresent Insulated Wire and Cable Company
Trenton, New Jersey

Don't Risk Losses in Your Plant

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

Delay may cost you more than replacing every ordinary fuse with a FUSETRON dual element Fuse — but by passing the word along that all purchase and stock records should call for FUSE-TRON dual element fuses, you have action that begets money saving.

SEND THE COUPON FOR MORE FACTS

BUSSMANN Mfg. Co. (Division of McGraw Electric Co.)
University at Jefferson, St. Louis 7, Mo.

Please send me complete facts about FUSETRON dual-element Fuses.

*Name*_____

*Title*_____

*Company*_____

*Address*_____

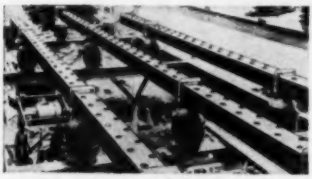
*City & Zone*_____ *State*_____ 1152

New equipment and developments

(Continued from page 10)

15—Ventilated bus increases current carrying capacity

Ventilated square copper tube bus has been developed by Chase Brass & Copper Co., Inc., a subsidiary of Kennecott Copper Corp., to provide increased current carrying capacity for a given area of metal. A-c capacity is said to be increased approximately 20 per cent. In addition, the square shape



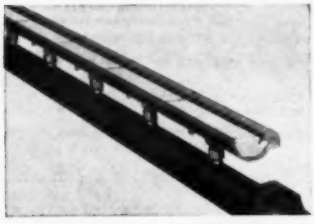
reduces skin effect, increases mechanical strength, and provides large contact surfaces for secure joints. Bus with sides ranging from 2 to 11 in. is available for a-c loads of 1310 to 10,600 amp, based on 30 C temperature rise.

16—Deicing chemical contains rust inhibitor

Addition of a phosphate type rust inhibitor to Ice Rem ice and snow melting chemical pellets has been announced by the manufacturer, Speco, Inc. It is said to safeguard against excessive rust when deicing pipes, drains, railway switches or metal ramps.

17—Burner provides greater efficiency

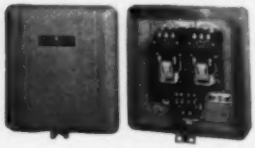
Burdett Manufacturing Co. has announced development of what is said to be a more flexible and efficient adaptation of the radiant heat principle for use in industrial ovens. Advantages claimed for the line burners, known as Radi-Heat, include maximum rate



of heat transfer, high fuel economy, reduced processing time, uniformity of product and low maintenance costs. Capacities range from 7000 to 45,000 Btu per hr.

18—Device automatically controls emergency power

When normal source fails, a control device developed by General Electric Company's Control Dept. automatically



transfers electric circuits to an emergency power source. The throwover panel, consisting of mechanically interlocked normal source and emergency source contactors and a pilot contactor, can also control standby equipment such as an auxiliary generator.

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19—Gear drives meet many requirements

Belt transmissions are eliminated by right angle gear drives designed by Johnson Gear & Manufacturing Co. The units, which are dust and weather proof, are available in a wide selection of types, sizes and ratios to meet requirements for many types of prime movers and driven equipment. They are adaptable for either vertical or hori-

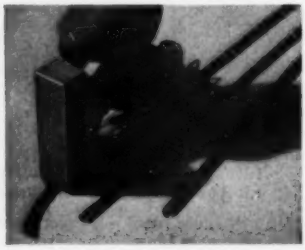
zontal prime movers with ratings of 15 to 450 hp. Advantages are outlined in available literature.

20—Multi-purpose hose reduces inventory

Five types of multi-purpose hose, marketed by the Mechanical Packing Div. of Flexrock Co., are said to make it possible for an industrial plant to reduce the number of hose types they may now find it necessary to stock. One type of the multi-purpose hose is said to take the place of as many as seven types of ordinary hose. Each is color-coded for identification.

21—Unit provides quick cable installation

Quick installation of cables and hollow tube lines is provided by an automatic fastening gun developed by The Heller Stapler Co. It is operated with one hand, leaving the other free to



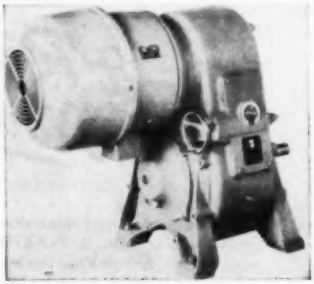
guide the work being installed. The unit drives an extra size band with leg lengths varying from 3/16 to ½ in.

22—Roller gear drives reduce cycle time

Roller gear drives, developed by Ferguson Machine & Tool Co., Inc. for high speed intermittent motions on automatic equipment, are said to decrease cycle time of machines and waiting time of the operator. Reduced vibration and low maintenance costs also are claimed. The units can be used to replace all types of Geneva drives, ratchet and crank mechanisms, air or cam operated indexing mechanisms or other intermittent motions—either linear or angular.

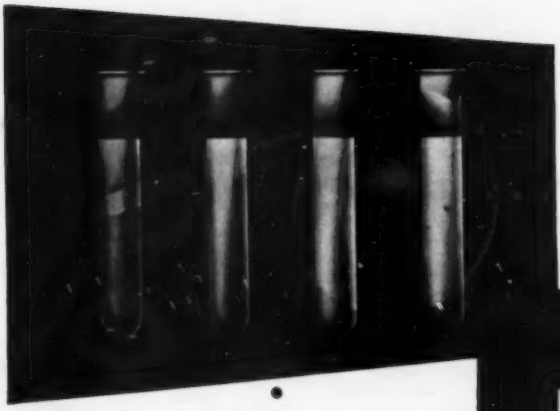
23—Variable speed units are totally enclosed

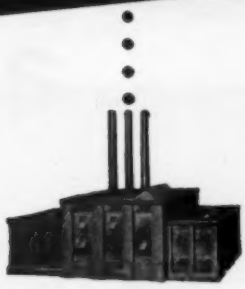
Sterling Electric Motors, Inc. has announced that their Speed-Trol variable speed electric power drives, in the



20 to 25 hp range, are now manufactured in totally enclosed fan-cooled models. Units with speed variations of 2 to 1, 3 to 1 and 4 to 1 are available.

(Continued on page 20)





Here's a sure way to control carryover and blowdown

Impure steam and excessive blowdown are two "bugaboos" that need not be tolerated by any power plant engineer, thanks to effective anti-foam agents.

Within recent years, the Betz organization has developed several anti-foam agents which have produced remarkable results both from a standpoint of better boiler operation as well as direct savings.

For instance, a large midwestern plant operated at 250 pounds pressure and used boiler feedwater softened by the hot lime soda process. The river water used as make-up at this plant varied widely in composition and was contaminated by a number of industrial wastes. Highly impure steam was produced with boiler water concentrations of approximately 3,000 ppm.

After analysis, Betz Engineers applied properly formulated anti-foam agents to this problem. Boiler water concentrations were raised to the extremely high value of 16,000 ppm before a similar steam impurity developed!

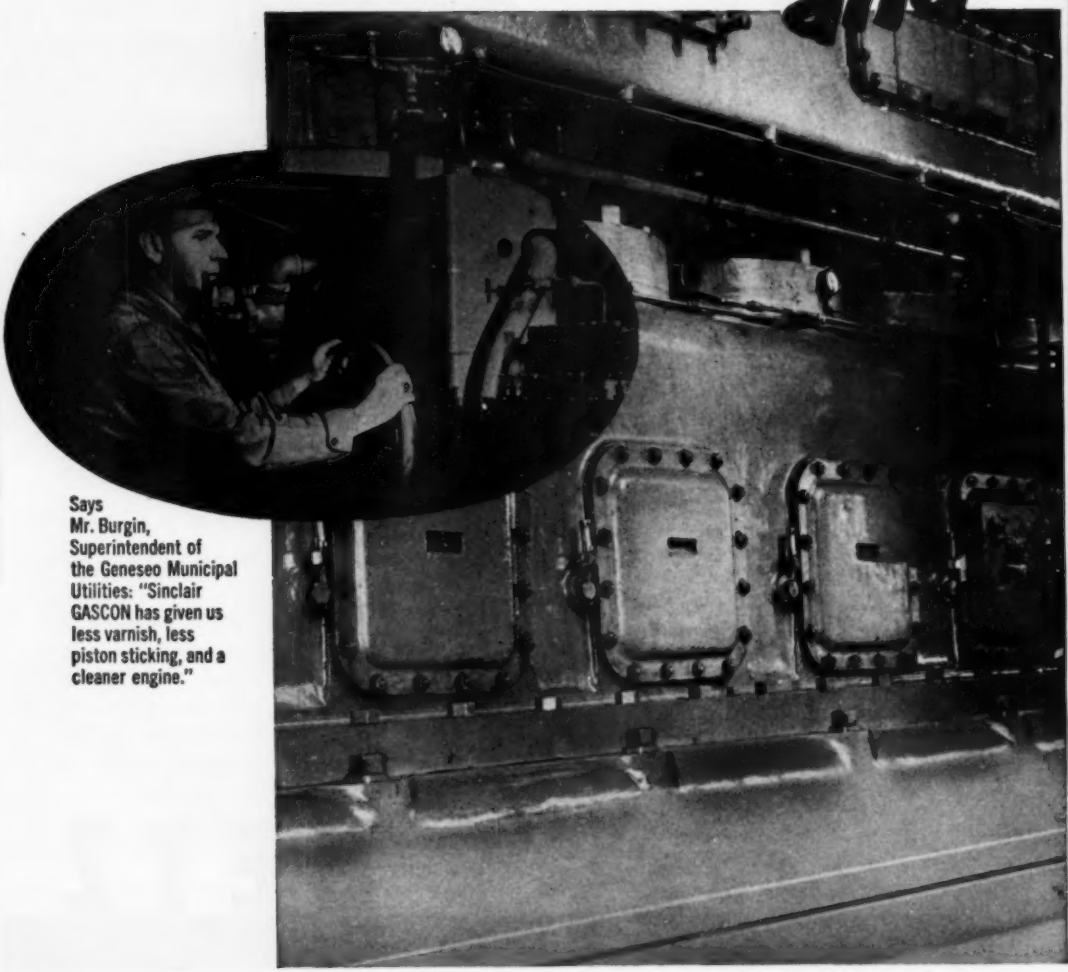
The positive control of carryover and boiler blowdown is only one of the many services extended by the Betz Organization. Let us explain to you how our *complete* engineering guidance can help you solve all your water problems. W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Pa. In Canada: Betz Laboratories Limited, Montreal 1.

For the complete story on carryover and blowdown control through the use of anti-foam agents, write for Technical Paper No. 115.

BETZ

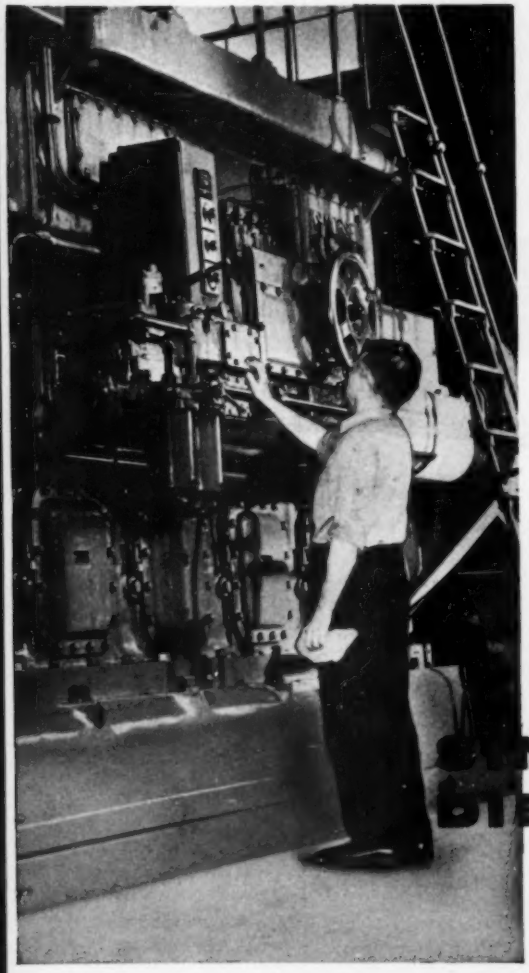
CONSULTANTS ON ALL WATER PROBLEMS

Light Plant Solves of Sticking and



Says Mr. Burgin, Superintendent of the Geneseo Municipal Utilities: "Sinclair GASCON has given us less varnish, less piston sticking, and a cleaner engine."

Problems Rings Carbon Build-Up!



For quite some time the Light Plant of Geneseo Municipal Utilities, Geneseo, Ill., had trouble with sticking rings, and with carbon deposits in the exhaust ports of its diesels. A few years ago these diesels were changed over to Sinclair GASCON D. Almost at once, it was noted that the troublesome conditions started to clear up. In the time since, sticking rings have become the rare exception and the carbon deposits are no longer a problem.

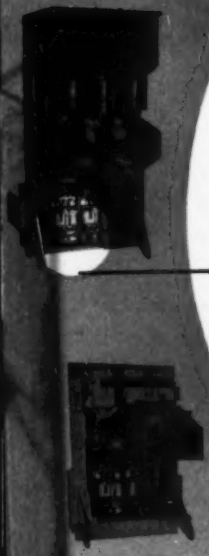
Furthermore, in 1947, a 1400 hp. Fairbanks-Morse engine, shown at left, was installed and filled with GASCON D. This engine has never had a sticking ring and is running remarkably clean, with exceptionally low cylinder wear.

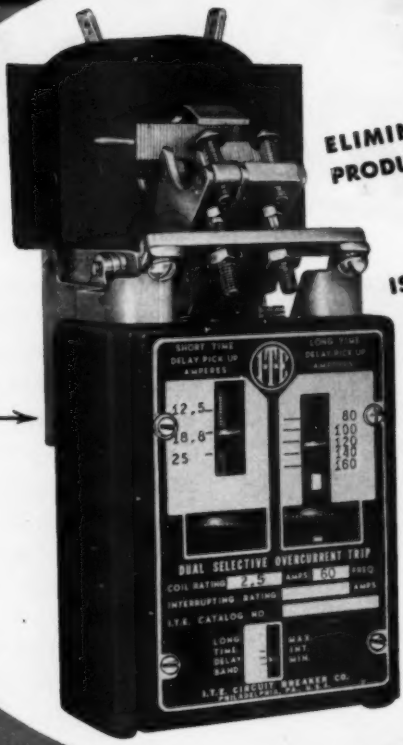
Perhaps GASCON® Oil can cure *your* diesel troubles, too. Get in touch with your nearest Sinclair Representative or write Sinclair Refining Company, 600 Fifth Ave., New York 20, N. Y.

SINCLAIR DIESEL OILS

prolong engine life

SERVICE CONTINUITY





ELIMINATES COSTLY PRODUCTION BREAKDOWNS

ISOLATES SYSTEM FAULTS

SAVES UP TO 63% ON INITIAL INVESTMENT

Direct-Acting Selective Overcurrent Trip Devices are available for I-T-E KA, KB, KC, and LG type circuit breakers in the following ratings:

15,000 to 100,000 amperes interrupting capacity

100 to 6000 amperes continuous

MODERN I-T-E DIRECT-ACTING SELECTIVE TRIP BREAKER PROTECTION

It's easy to protect production and profits against disastrous total power failure in complex electrical distribution systems. The cost is lower than you think.

Modern Selective Tripping—pioneered and developed by I-T-E—eliminates the failings of inadequate systems which can tie up an entire plant or utility with a single short somewhere along the line.

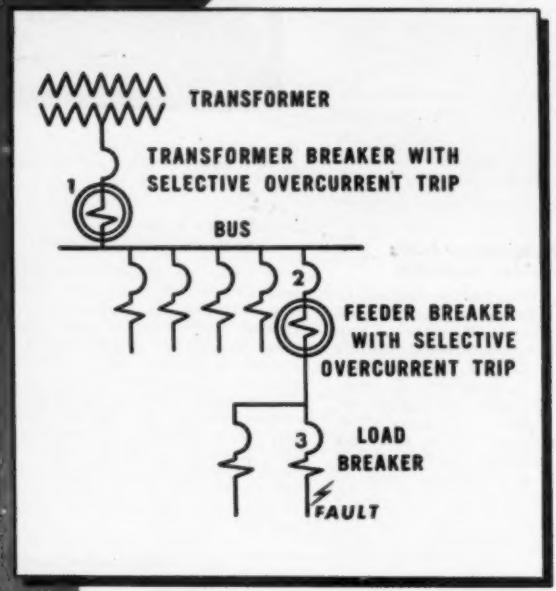
Selective Tripping limits the fault to *one* affected area only. Production continues—*uninterrupted*—throughout the rest of the system.

I-T-E TRIP DEVICE SAVES 63% ON INVESTMENT

Secret of this efficient delayed-action circuit breaker protection is the I-T-E *Direct-Acting* Selective Overcurrent Trip Device. Developed by I-T-E engineers to replace complex, expensive transformer-relay auxiliary apparatus, this unique tripping device gives one more reason for I-T-E leadership in the design and application of quality circuit breakers and switchgear.

Positive—compact—dependable, the low-cost I-T-E Trip Device saves you up to 63% on accessory cost per circuit! And because it is a *direct-acting* device—an integral part of the circuit breaker—no additional space is required on your switchboard panel. Assure service continuity. Install I-T-E Selective Tripping in *your* plant.

COSTS LESS THAN YOU THINK



HOW SELECTIVE TRIPPING WORKS

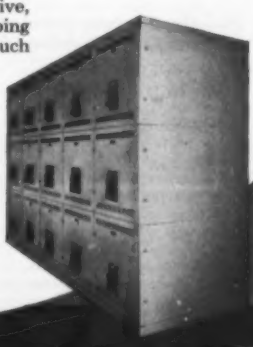
I-T-E circuit breakers, arranged in series, are *preset* to open in *definite sequence* (3, 2, 1 in diagram). If there is a sudden overcurrent or short circuit in any branch of the system, only the breaker (3) closest to the fault will open. Other breakers—other production machinery—in the system are unaffected.

ANOTHER I-T-E "FIRST"

Here is one more I-T-E "first"—another major I-T-E development to help industry protect production and save. Originally developed for the Navy during the War, the I-T-E Direct-Acting Selective Overcurrent Tripping Device has since been refined and perfected for industrial and utility use.

Call on I-T-E engineers—specialists in circuit breakers and switchgear—to see how positive, dependable I-T-E *Direct-Acting* Selective Tripping can protect your plant operation. See how much you can save.

For selection and application data on I-T-E large air circuit breakers, including selective tripping arrangements write for Catalog Section 1003 today. I-T-E Circuit Breaker Co., 19th and Hamilton Sts., Phila. 30, Pa.



I-T-E

LOW-VOLTAGE SWITCHGEAR

I-T-E CIRCUIT BREAKER CO. · 19TH AND HAMILTON STS. · PHILADELPHIA 30, PA.

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New equipment and developments

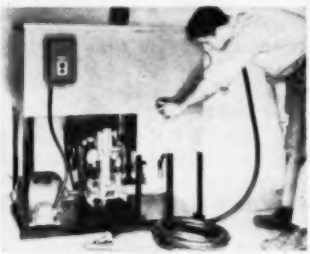
(Continued from page 14)

24—Higher rating is applied to power cable

General Electric's Wire and Cable Dept. has announced that Super Corona power cable for service up to and including 8000 v is now rated at 85 C copper temperature. The company states this can also be applied to cable in service. Above 8000 v, ratings continue to be based on 80 C.

25—Cleaner is designed for heavy duty

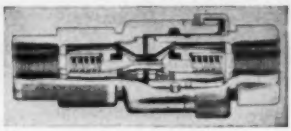
For heavy duty cleaning jobs, Livingstone Engineering Co. has designed the Speedylectric Hydrajet. Plant steam



can be used, when available, or an electric boiler can be supplied. The unit provides a pulsating jet of from 4 to 8 gpm of hot soap and water at nozzle pressures to 600 psi. Detergents and solvents also can be used.

27—Valved coupler is for hydraulic lines

Henry Valve Co. has introduced a make and break, double shut-off valved coupler for use with pneumatic and



hydraulic lines. In operation, the two piston valves open when the two halves of the unit are coupled together. Units have ⅜ in. female pipe thread connections. A data sheet is available.

TO REQUEST ADDITIONAL FREE DATA

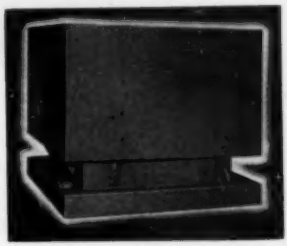
Insert "key" numbers on return post card found on page 147. Our Reader's Service Department will handle your request promptly

28—Heat exchanger tubes are welded aluminum

Low cost and protection against corrosion are advantages claimed by Aluminum Company of America for heat exchanger tubes made of longitudinally butt welded Alclad 3S-H12 aluminum alloy sheet. A protective aluminum coating on the inside and outside surfaces gives double corrosion protection. Typical tensile strength is 17,000 psi and yield strength is 14,000 psi. Tubes of 1 in. OD with wall thicknesses of .049 or .065 in. and lengths of 12, 14, 16 and 20 ft are standard, with other lengths available on order. Other tube sizes may be produced in the near future.

29—Roof ventilator features simplified construction

All complicated mechanisms and counterweights have been eliminated in the design of an automatic fan-powered ventilator known as Airjet, according to the manufacturer, Hartzell Propeller Fan Co. Two hinged



panels, which form a peak roof, open automatically when the fan is started and close when it stops.

30—Switch is for multiple circuit control

Toggle switch assemblies, developed by Micro Div. of Minneapolis-Honeywell Regulator Co. to meet vibration resistant requirements, are said to have many applications where manual or mechanical multiple circuit control is required. They have from 1 to 10 double-throw switching elements, all operated by one lever. Several detented and self returning lever types are available. Each switching element is UL listed at 10 amp up to 250 v a-c, and will handle 30 v d-c inductive loads of 10 amp at sea level. A data sheet is available.

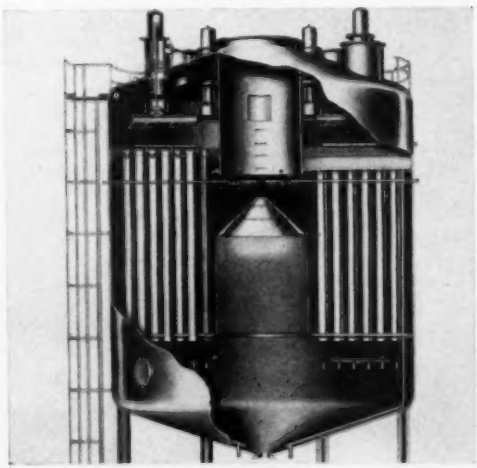
(Continued on page 22)

26—Electrostatic precipitator permits ready manifolding of multiple units

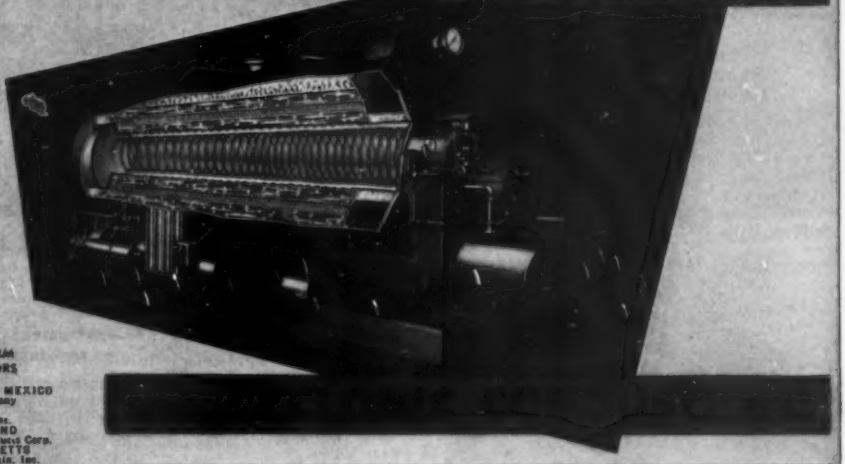
All inlets and outlets are located at the top of a water film, pipe type Cottrell blast furnace precipitator developed by Western Precipitation Corp. This design is said to permit ready manifolding of multiple arrangements so that more units can be economically used with a net gain in efficiency at periods when any one unit is down.

Gas entering the inlet travels downward through a large low velocity opening and is uniformly distributed around and down the outer walls of the collecting electrode pipes by means of a gas deflector cone. The manufacturer states that the top center inlet precipitator, in addition to achieving uniform distribution of gas, improves flue connections, simplifies insulator compartments and opens up pipe spacing for ease of adjustment and less tendency to clog with encrustations—all with no increase in shell size.

Manholes permit access to the section above the header plate. A sealed door in the gas inlet flue permits operators to reach the top of the deflecting cone. From this point the upper ouside of the collecting electrode pipe can be inspected and, if necessary, high pressure flushing can be accomplished. At the lower end of the cylindrical section an additional manhole permits entrance to the hopper bottom. Construction is described in a 12-page bulletin.



66% more steam generating POWER



Cyclonic Combustion is the revolutionary new flame control that reduces heating surface requirements from 5 to just 3 sq. ft. per boiler horsepower . . . to produce 66% more steam generating power per sq. ft.

Used exclusively in Cyclotherm Steam Generators, Cyclonic Combustion controls flame characteristics in a revolving spiral vortex traveling the full length of the combustion chamber. The cyclonic flame constantly heats every part of the chamber, itself a complete heat transfer unit. 65 to 75% of the heat transfer is obtained in the chamber, with the result that only one return pass is required to deliver a guaranteed minimum efficiency of 80%.

The high efficiency of Cyclonic Combustion, plus simple compact design enables Cyclotherm generators, complete with fiber glass insulation, to save up to ⅓ the space of conventional package steam generators.

Cyclotherm generators operate on gas, oil or a combination of both. Complete combustion of fuel particles in the combustion chamber results in greater fuel savings and eliminates the need for extensive stack facilities. Inspection and cleaning is a minor operation with no time loss caused by boiler shutdown.

Cyclotherm arrives complete . . . 5 easy connections—fuel, electricity, water, steam and a simple flue—and Cyclotherm is ready to generate steam for any purpose. Full power operation from a cold start in 15 to 20 minutes. Boilers are designed for 18 to 500 h.p., 15 to 200 psi pressures.

The Cyclotherm meets all state requirements and is built in accordance with A.S.M.E. and National Board Standards and bears the label of Underwriters Laboratories, Inc.

Proved superior in thousands of installations, Cyclotherm steam generators with Cyclonic Combustion offer the most efficient and compact package steam generator on the market today. Write today for the free illustrated folder.

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HAVERFORD, PENNSYLVANIA
The Thomsen-Willett Corp.
HOUSTON, TEXAS
Newell Engineering Corp.
INDIANAPOLIS, INDIANA
John L. Shank Heating Equipment
KNOXVILLE, TENNESSEE
Deagster Brothers, Inc.
LAKE PLACID, NEW YORK
Carl A. Bovard Company
LOS ANGELES, CALIFORNIA
Pittsburgh Water Heater Sales Co., Inc.
MOBILE, ALABAMA
Air Conditioning Engineers, Inc.
NEW YORK, NEW YORK
Cyclotherm Division United States Radiator Corp.
OMAHA, NEBRASKA
Anderson Brothers Engineering Co.
PHOENIX, ARIZONA
Wm. Berrington & Son, Inc.
PITTSBURGH, PENNSYLVANIA
J. Clifford Hannah
PORTLAND, OREGON
Caleson Engineering Company
REDFIELD, S. DAKOTA
Dakota Oil Burning Boiler Sales
RICHMOND, VIRGINIA
Hungerford, Inc.
ROCHESTER, NEW YORK
Replacement Parts, Inc.
SALT LAKE CITY, UTAH
Mechanical Equipment Company
SAN FRANCISCO, CALIFORNIA
M. J. Gigy & Associates
ST. LOUIS, MISSOURI
Kline Boiler & Engineering Co.
TOLEDO, OHIO
The Shaw Kendall Engineering Co.
TORONTO, ONTARIO, CANADA
Holbeck Corporation Limited
WASHINGTON, D. C.
Iron Fireman Sales Corporation

EXPORT DIVISION

NEW YORK, NEW YORK
Drake American Corporation

Meet the Cyclotherm folks at Booth 15C, National Power Show, Grand Central Palace, New York City, December 1-6.

CYCLOTHERM STEAM GENERATORS

Cyclotherm Division U. S. Radiator Corp.
Dept.
Oswego, New York

☐ Please send without obligation my copy of "All Your Questions Are Answered by Cyclotherm."

☐ Please send a Cyclotherm representative to speak to me about Cyclotherm.

NAME_____

FIRM_____

ADDRESS_____

New equipment and developments

(Continued from page 20)

31—Aftercooler removes oil and moisture from lines

Oil and moisture are removed from compressed air lines by a water-cooled aftercooler designed by The Heat-X-Changer Co. Longitudinal fins are said to provide maximum heat transfer with minimum air pressure drop. The manufacturer states that air can be cooled

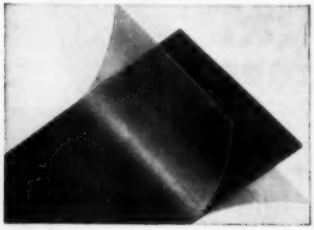
within 10 deg of water supply temperature. The units, which can be installed horizontally or vertically, are for compressed air systems from 1 to 15 hp.

32—Belt dissipates static charges

For safely conveying materials under conditions where a static charge is undesirable or dangerous, the Main Belting Co. has developed a static-free conveyer belt. Known as Mark 40, it is a heavy duty stitched canvas type with conductive neoprene coating to dissipate the charge. It is available in 37½ or 39 oz duck in width to 108 in. i

33—Electrical insulation is tough and flexible

Aboglas, a class B composite insulation developed by Natvar Corp., consists of a layer of varnish saturated as-



bestos paper sandwiched and bonded between two layers of varnished open-weave Fiberglas. It is said to be tough; flexible; inexpensive; cleaner and easier to handle; and will conform to irregular surfaces without application of heat. Two thicknesses, .025-.027 in. and .050-.054 in., are available. A 4-page bulletin describes its use.

34—Rheostat features close control

For use in electronic and industrial control equipment, Vitrohm ring type rheostats manufactured by Ward Leonard Electric Co. feature a new contact arm and drive shaft assembly

said to offer smooth, close control without backlash. Ratings are 25 and 50 w, based on 300 C rise in 40 C ambient. Details of design are described in 4-page folder.

TO REQUEST ADDITIONAL FREE DATA

Insert "key" numbers on return post card found on page 147. Our Reader's Service Department will handle your request promptly

35—Valve is designed for quick cleaning

For sanitary control of food processing operations, The Foxboro Co. has developed a stainless steel 2-way

valve featuring quick and easy disassembly for cleaning. Known as Saniflow, it is said to have high flow capacity and the action of a reversible diaphragm motor is said to be friction-free. The plunger is equally effective in throttling or open-shut control. Standard line sizes, 1 through 3 in., are available.

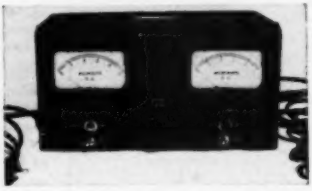
36—Plastic pipe has many advantages

In addition to reduced installation costs, many advantages are claimed by Reflin Co. for a glass fibre-reinforced thermosetting plastic pipe developed for use in pressure transmission piping. It is resistant to most corrosive elements, and its smooth wall surfaces discourage deposits. Operating temperatures are –90 to 230 F; working pres-

sure is 200 psi; and burst pressure is 1000 psi. Standard sizes are 4, 6, 8, and 10 in. OD, in 20 ft lengths.

37—Instrument is designed to test insulation

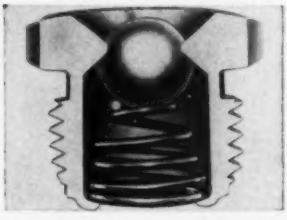
Calculation of d-c resistance based on test voltage and output current flow is provided by the model 424 Hypot, a testing instrument developed by Associated Research, Inc. Designed for electrical insulation tests requiring various potential stresses, it has a con-



tinuously variable voltage output and a means to measure current output. Standard range is 0-5000 v d-c, and 0, 5, 10, 50 and 100 microamp.

38—Grease fittings are flush type

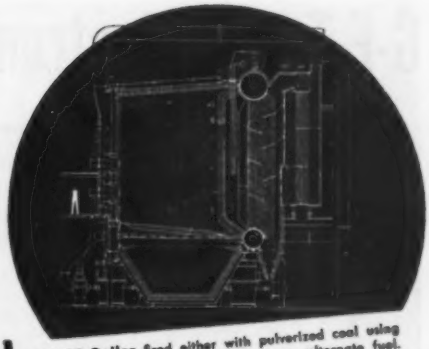
Flush type grease fittings manufactured by Universal Lubricating Systems, Inc., are said to remedy the



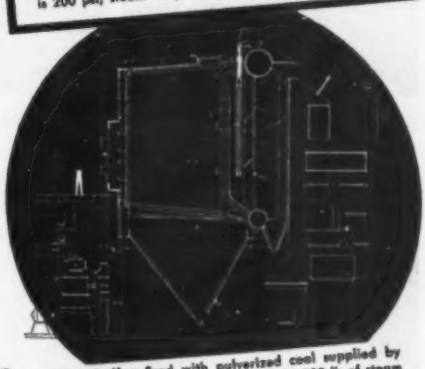
problem of grease fittings being knocked off by a heavy blow or collision. The units, which are offered in all regular sizes, are described in an available catalog.

(Continued on page 28)

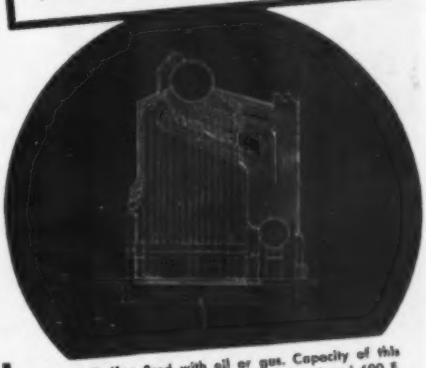
Leaders in every Industry choose VU



VU-50 Boiler fired either with pulverized coal using C-E Raymond Bowl Mills, or oil as an alternate fuel. Capacity is 100,000 lb of steam per hr. Steam pressure is 200 psi; steam temperature is 500 F.



VU-50 Boiler fired with pulverized coal supplied by C-E Raymond Bowl Mills. Capacity — 150,000 lb of steam per hr; steam pressure, 600 psi — temperature, 700 F.



VU-10 Boiler fired with oil or gas. Capacity of this unit is 40,000 lb of steam per hr at 420 psi and 600 F. VU-10 capacities range from 10,000 to 60,000 lb of steam per hr. They may also be fired by spreader, underfeed or chain grate stokers.

More and more . . . in industry after industry . . . you will find C-E Vertical-Unit Boilers (Type VU) establishing the standards for efficient steam production.

In Textile Mills, for example . . . where steam must be reliably available for process work . . . many of the industry's leaders, as evidenced by the representative list below, are users of Type VU Boilers.

Why list only large companies when VU Boilers are also used by many smaller textile mills? Because such names form a significant guide for a prospective boiler buyer, in the same sense that the buying decisions made by operators of large truck fleets can be a reliable guide for the man who wants to buy a single truck. Moreover, big companies buy boilers frequently . . . therefore their experience is always up to date. And they buy them for plants in many locations, using many different fuels. Thus they have the breadth of experience that is required for making the soundest equipment selections.

So if you need steam — from 10,000 to 350,000 pounds per hour — remember that leading companies in every industry are profiting from the advanced design . . . sound construction . . . reliability . . . of C-E Vertical-Unit Boilers.

Typical Leaders in the Textile Field that have purchased C-E Vertical-Unit Boilers for one or more mills

American Thread Company
American Viscose Company
American Woolen Company, Inc.
Bancroft & Sons Company
Bigelow-Sanford Carpet Company
Burlington Mills Corp.
Cannon Mills Company
Celanese Corporation of America
Cone Mill Corp.
Congoleum-Nairn, Inc.
Dan River Mills
Goodall-Sanford, Inc.
Mohawk Carpet Mills, Inc.
Standard-Coosa-Thatcher Company
Textron, Inc.
West Point Manufacturing Company

COMBUSTION ENGINEERING — SUPERHEATER, INC.

200 Madison Avenue, New York 16, N. Y.

B-572-A

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS: ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

G-E Testing Instruments for Your Every Need

TWO NEW RANGES PERMIT WIDER APPLICATION

1 Motor Starting Current Measured With NEW AK-1A Volt-ammeter

Now, with new pointer stop and additional voltage and ampere ranges, the new AK-1A hook-on volt-ammeter is an even more versatile a-c testing instrument. The pointer-stop permits reading of motor starting currents. You can use your AK-1A volt-ammeter for spotting overloaded feeders, open fuses, and improper operation of circuit breakers.

Ranges: 0-7.5/30/75/300/750 amperes
0-150/300/750 volts

Accuracy: ±3% full scale.

Extra-sturdy construction assures years of service.

Weight: 3½ pounds.

PRICE: $66.75*

KILOWATTS ARE CHECKED IN OVERLOAD AREAS

2 Check Kilowatts Directly With Compact AK-2 Hook-on Wattmeter

Both single and polyphase circuits can be measured quickly and easily with this hook-on wattmeter. Ideal for trouble-shooting power surveys and load tests, this instrument can be used to make sure that motors operate at rated capacity. In addition to measuring kilowatts, this AK-2 hook-on wattmeter will measure vars in balanced three-phase circuits.

Ranges: 0-3/6/20/60/200/300 kw
15-600 amperes
100-600 volts

Accuracy: ±5% full scale

Weight: 4 pounds.

PRICE: $84.75*

AK-3 SIMPLIFIES CAPACITOR INSTALLATION

3 Spot Power Losses Easily With Type AK-3 Power-factor Meter

This new hook-on power-factor meter enables you to measure power factor without interrupting service. The AK-3 can be used on any balanced 3-phase circuit. When making capacitor surveys, you'll find the hook-on power-factor meter a valuable time saver. Improved power factor means relief to overloaded feeder circuits and transformers.

Ranges: 100-600 volts
15-600 amperes

Accuracy: 0.05 PF

Weight: 4½ pounds

PRICE: $84.75*

4 Quickly Determine The Phase Sequence of Polyphase Circuits

A handy, pocket-sized phase sequence indicator for determining the phase sequence of polyphase circuits is designed to save time for construction and maintenance men, trouble shooters, test men, and engineers. To use—merely connect the three leads to correct voltage terminals; one lamp will glow to show the direction of phase sequence.

Ratings: 120/240/480 volts or
120/240/600 volts

Weight: only 22 ounces

Dependable: has no moving parts or fragile filaments.

PRICE: $28.14 OR $31.77*

TO OBTAIN READING SIMPLY CONNECT THREE LEADS

5 Lighting Circuits Easily Measured By High Accuracy AC Portable

Used for both testing and maintenance work these compact high accuracy portables are ideal for lighting surveys. Small in size, they are easy to carry and store. Just the right amount of damping gives you maximum ease of reading. The AP-9 is available in almost all ranges as voltmeters, ammeters, milliammeters, single-phase wattmeters, and also with pointer-stop mechanism.

Accuracy: ¾ of 1% full scale for AP-9 (a-c)
½ of 1% of full scale for DP-9 (d-c)

Weight: about 2½ pounds.

PRICE: $53.00 AND UP*

ACCURATE TO WITHIN ¾ OF 1% OF FULL SCALE

6 Regulator Surveys Simplified With 30-day Type CF Inkless Recorder

With the Type CF Inkless Recorder one man can supervise the power requirements for an entire plant. Charts last up to 30 days; no ink to freeze or evaporate; available in a variety of voltage ranges; weather seal and temperature compensation permit use out-of-doors. Checking regulators or making plant surveys is made easy with this lightweight portable.

Accuracy: Up to ±1½% full scale.

Available for a-c or d-c operation.

Weight: only 12 pounds.

TYPICAL PRICE: $110.00*

WEATHER SEAL PERMITS OUT-OF-DOORS OPERATION

*Manufacturer's suggested retail price. 602-240

For further information, contact your nearest G-E Apparatus Sales Office, Agent, or Distributor

GENERAL ELECTRIC

New equipment and developments

(Continued from page 22)

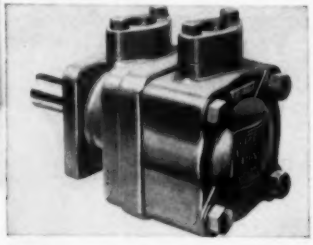
39—Push-button switch features small size

Push button switches, measuring 1.047 in. from end of plunger to end of terminal tips and ½ in. diam at the widest point, have been developed by Grayhill Co. Contact resistance for the series 23 switches is reported to be .007 ohms maximum before use, and .015 ohms maximum after 200,000 operations. One unit, No 23-1, is nor-

mally open and has a single pole, single throw, momentary contact arrangement. It is rated ¼ amp. 115 v, a-c non-inductive.

40—Hydraulic motors are compact

Vane type oil hydraulic motors developed by Vickers, Inc. are said to offer high efficiency and long life. Mounting adaptability is provided by a choice of four combinations for inlet



and outlet positions with flange or foot mounting for direct, belt, chain or gear drive. Units with 5.0, 6.5 and 26 hp output are available. Literature describes construction.

41—Level indicator measures continuously

Continuous level measurement without mechanical or pneumatic means is provided by an electronic instrument developed by Fielden Instrument Div. of Robertshaw-Fulton Controls Co. Known as Telstor, it measures most types of liquids, viscous fluids or granular solids stored in almost any type of container. The instrument consists of an electronic unit, an insulated electrode and an indicator unit which can be mounted up to one mile from the material being measured. Power requirements are 115 v, 60 c, 15 w.

42—Wire connector is set screw type

Improved design is said to be incorporated in the Hi set screw type wire connector developed by Holub

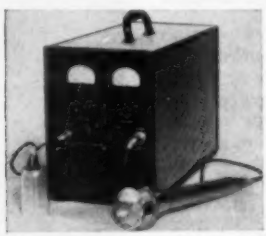
Industries, Inc. Units for solid and stranded wire, as well as combinations of both, are approved by Underwriters' Laboratories. Advantages and construction are described in a data sheet.

TO REQUEST ADDITIONAL FREE DATA

Insert "key" numbers on return post card found on page 147. Our Reader's Service Department will handle your request promptly

43—Dynamic balancing machine is easy to operate

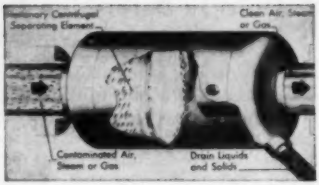
International Research and Development Corp. has developed a portable, rugged and easy to operate electronic machine, the model 652 Vibratron, for analysis, evaluation and correction of vibration. It is said to measure the amplitude and frequency of vibrations and, by means of a stroboscopic light, discover the source. It consists essentially of a vibration pickup, a multichannel electronic circuit and a strobo-



scopic lamp. Operation is on 110 v, 60 c current. A 4-page folder describes design features.

44—Purifier provides increased efficiency

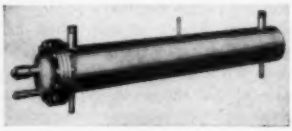
Design of the Hi-eF line type purifier has been simplified, according to V. D. Anderson Co., to combine low initial cost with increased efficiency. The unit is said to remove more than 99 per cent of all dirt, oil and moisture from steam, air, gas and vapor lines. Standard sizes


Stationary Centrifugal Separating Element
Clean Air, Steam or Gas
Contaminated Air, Steam or Gas
Drain Liquids and Solids

up to 24 in. are available for pressures to 600 psi. Operation is described in a bulletin.

45—Evaporators are for refrigeration service

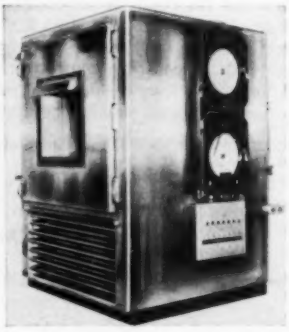
For service in refrigeration and air conditioning systems, Taco Heaters, Inc. is manufacturing type CWF shell and tube liquid coolers and direct expansion evaporators. Constructed according to ASME specifications, the evaporator is tested at 300 psi and is certified for 150 psi working pressure. Shell diameters of 8 to 20 in. are available in 2 in. increments, and tube



bundle lengths are 5 to 13 ft in 1 ft lengths. Complete information is given in an 8-page bulletin.

46—Test chambers are standardized

To supply industry with standard environmental test chambers for conducting termperature-humidity tests, Tenney Engineering, Inc. has standardized on five basic chamber types. Known as series TH, the units automatically maintain humidity from 20 to 95 per cent through a temperature range of

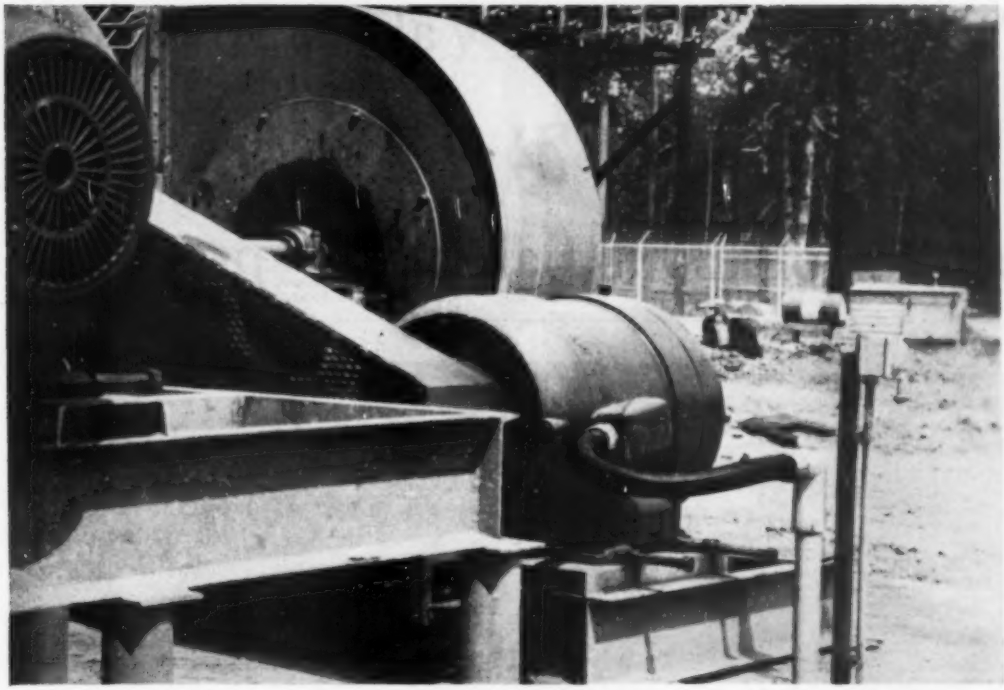


35 to 185 F. Minimum dew point is 33 F. Sizes from 22 x 19 x 48 in. to 48 x 24 x 48 in. are available, equipped with various types of controls.

(Continued on page 32)

"We choose SEALTITE electrical conduit to

isolate vibration and protect against moisture"—*J. M. Huber Corp.*



TYPICAL OUTDOOR INSTALLATION of flexible Sealtite electrical conduit at the Huber Carbon Black Plant, Baytown, Texas. Gulf Coast weather, noted for its excessive moisture, necessitates this reliable, *liquid-tight* conduit.

IT'S WET IN BAYTOWN, TEXAS. In this Gulf Coast town, high humidity and heavy precipitation are the rule. Under such conditions outdoor wiring presents a problem at the carbon black plant of the J. M. Huber Corporation. Only a liquid-tight electrical conduit can protect the wiring. At the same time vibration and constant flexing from blower motors must be overcome. Sealtite*, a unique synthetic-jacketed conduit with a *flexible* steel core, meets these demands admirably.

Sealtite is as flexible as garden hose. You can install it more quickly than rigid conduit. You can cut it easily. You can take it down and move it without trouble. You can use it in cramped quarters or where conduit must either bend or allow for vibration and movement.

Sealtite is available at your Electrical Supply House. It uses standard rigid electrical conduit fittings. For informative Bulletin No. C-201, write to The American Brass Company, American Metal Hose Branch, Waterbury 20, Connecticut. In Canada: The Canadian Fairbanks-Morse Company, Ltd.

*Trademark

specify

for flexible, liquid-tight electrical conduit— SEALTITE

AN ANACONDA® PRODUCT

What's NEW about America's OLDEST maker of industrial rubber products?

This is the big news: New York Belting & Packing Co., founded in 1846, has now acquired the sole sales rights to the famous Gilmer V-Belts, Gilmer "Timing" Belts and other Gilmer products.

The industry of America can now expect even greater service from the NYB&P Distributor. He is the keystone of supply, as well as a willing trouble shooter for his customers. Today he is equipped with a *complete* quality line of industrial rubber products —a line that will permit him to outperform competition, satisfy every need. Included are such outstanding products as:

Gilmer V-Belts and Gilmer "Timing" Belts • NYB&P Conveyor Belting
Test Special Transmission Belting • Hy-Test Steam Hose • Great Seal Packings

NEW YORK BELTING & PACKING CO.

1 Market Street, Passaic, New Jersey

The famous "Line of Nine" covers 90% of industrial packing needs

Great Seal Asbestos Packing—Braid or Twist—**Style 252 or 251.** For packing globe and angle valves against steam, air, oils and acids.

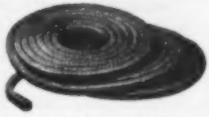
Great Seal Vee Packing—**Style 23010.** For packing reciprocating rods and plungers against hot or cold water, brine, oil, gasoline, ammonia and hydraulic pressures up to 8000 lbs.

Indestructible Sheet Packing—**Style 10.** For sealing joints against steam, air, hot or cold water, ammonia, oils, gas, creosote and such substances.

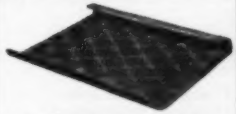
THESE 9 outstanding NYB&P brands will solve 90% of your normal packing problems—and NYB&P has a complete line to take care of the other 10%. Each does an economical, efficient job, is thoroughly dependable. Your local NYB&P Distributor is ready to help you select the proper packing for your specific needs. Call on him for your copy of our handy Packing Recommendation Chart.

NEW YORK BELTING & PACKING CO. NYB&P INDUSTRIAL RUBBER PRODUCTS Since 1846

Great Seal High-Pressure Packing—**Style 1003.** For packing rods and valve stems of engines, air compressors and pumps against pressures of 150 lbs. and higher, superheated steam, high pressure gas and air. Oil-resistant.



Great Seal Centrifugal Pump Packing—**Style 204.** Use this for packing rods in centrifugal pumps against any pressure of oils, hot and cold water.



Fire Superheat Sheet Packing—**Style 1846.** A non-absorbent, heat-resistant packing for all flange joints against superheated steam, acids, creosote, ammonia; also on gasoline and oil engines.

Great Seal Fine Hydraulic Packing—**Style 7.** For packing pistons on inside-packed pumps against hot or cold water and oil; also for end rings used under severe hydraulic conditions.

Great Seal Flax Packing—**Style 52.** For such hydraulic packing service as hydraulic elevator plungers, hydraulic presses and cold-water pump plungers.

Great Seal Cross Expansion Packing—**Style 231.** Use this for packing rods and plungers against medium steam, hot or cold water, air, gas and ammonia.

NEW YORK BELTING & PACKING COMPANY

1 MARKET STREET, PASSAIC, NEW JERSEY

THE

BOILER ROOM BOTH

STEAM COSTS

Operating men figure their costs in pounds of steam, management figures the cost in dollars, but the records of both will always prove—*you pay less for steam when you use Preferred!*

Today's up-to-date operating engineers want facts, figures, and sound engineering, all combined to give them maximum thermal efficiency at minimum costs. These men know the need for scientific downdraft gas travel, the importance of precision firing over a wide load range and how important it is that their equipment burn, ***efficiently, all types of gas and oils,*** regardless of viscosity, temperature or grade—and that's why you'll find more and more operating engineers saying "Preferred steam costs us less!"

Their Records Agree

From carefully-kept records, management has learned that there *is* a difference in steam-generating equipment. They *know* how much installation costs they save on Preferred's Unit Steam Generator that needs no stack, no special foundation or extra, high head room. They've learned, from actual experience, how *dependable* it is and how definitely positive the savings they make when their Preferred records show, year after year, *an actual thermal efficiency of 80%!*

Custom-Built To Job Specification and available in a wide range of sizes from 20 to 600 BHP, Preferred's Unit Steam Generators are fired by light or heavy oil, natural or manufactured gas, alone or in combination. Shipped *completely shop assembled,* tested, run in and ready for service lines hook-up, the Preferred Unit Steam Generator's fast becoming industry's first choice when it comes to a dependable, completely packaged heat and power unit.

ONLY PREFERRED CAN OFFER YOU ALL THESE FEATURES

1. *5 Square Feet of Heating Surface* per boiler horse power. Heat transfer surface commensurate with long life and high efficiency.
2. *Four Pass Gas Travel* assures uniform distribution of generated heat. Clean heat transfer surfaces to minimize tube cleaning and lower stack temperature.
3. *Down Draft Design.* High, guaranteed operating efficiency, plus low off-period losses. reduces over-all operating costs.
4. *Induced Draft.* Smoother starting, higher combustion efficiency, less refractory upkeep, eliminates poisonous fumes in boiler room.
5. *Intermediate Furnace Position.* Protects tube areas, safeguards shell from unequal heat distribution.
6. *Expansile Precipitator.* Clean, smokeless operation. Maximum gas velocities maintained equally in *all* tubes of pressure vessel.
7. *Staggered Tubes.* Thorough wiping of entire tube surfaces during maximum or minimum operation. Faster heat pick-up rate.
8. *Anti-Stress Deck.* Keeps sections of rear tube sheet—above and below water line—in close balance. Prevents unequal stress action within tube area.
9. *Dual Purging Action.* An important safety factor. Entire vessel is purged of gas vapors before *and* after firing.
10. Horizontal Rotary Oil Burner, Starts, ignites, follows load, shuts off, cleans and purges itself *automatically.*

Remember **THERE IS A DIFFERENCE!**

AND THE **BOARD ROOM AGREE**

YOU LESS *with* PREFERRED

Five Square Feet

Induced Draft

Staggered Tubes

Anti-Stress Deck

PREFERRED UTILITIES Rigged for Results ENGINEERED

VISIT OUR BOOTH AT THE **20TH NATIONAL POWER SHOW**
DECEMBER 1-6, 1952
BOOTH 60-61

PREFERRED

UTILITIES MANUFACTURING CORP.
1860 BROADWAY · NEW YORK 23, N.Y.

New equipment and developments

(Continued from page 28)

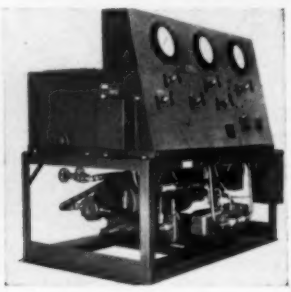
47—*Unit heater provides controlled heat*

Edwin L. Wiegand Co. has added a 20 kw unit to their Chromalox UB series electric unit heaters. Suitable for mounting on floor, wall or ceiling, it has adjustable louvers which deflect air

stream up or down approximately 20 degrees. It can be used as a basic heat source, or to supplement a central heating system. Operation is on 230 or 460 v, single or three phase.

48—*Gas booster is hydraulically driven*

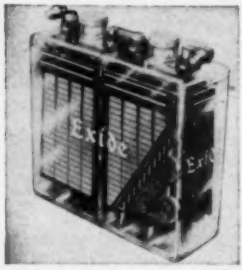
Haskel Engineering & Supply Co. has developed a hydraulically driven compressor booster which increases 300 to 2000 psi bottled gas to any given output pressure up to 12,000 psi.



With a 10 hp motor, it delivers approximately 1.5 cfm up to 1250 psi over input bottle pressure and approximately .9 cfm from 1250 psi up to maximum receiver pressure.

49—*Batteries incorporate transparent plastic case*

Lower initial cost, increased efficiency and long life are among advantages claimed for type CME Exide-Manchex batteries developed by The Electric Storage Battery Co. Transparent plastic containers are used. Available as either 2 or 3 cell, they are



built to meet rigorous service demands in stationary small power applications. Capacities range from 8 to 24 amp-hr at the 8 hr rate. Construction is described in an 8-page booklet.

TO REQUEST ADDITIONAL FREE DATA

Insert "key" numbers on return post card found on page 147. Our Reader's Service Department will handle your request promptly

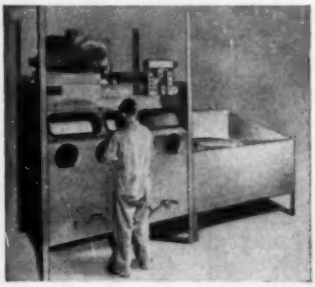
50—*Heater warms engine coolant water*

Vapor Heating Corp. has developed an electric immersion standby heater to warm coolant water of diesel-electric locomotives during winter standby periods. A centrifugal pump circulates water through the heater and engine's cooling system. Thermostats control

heating elements, and an alarm bell warns if the unit is not operating properly. Electric current, 220 or 440 v a-c, is provided by a connection installed outside the locomotive. Two sizes, 75,000 and 120,000 Btu per hr, are available.

51—*Wet blasting machine features versatility*

Push button control is featured in a wet blasting machine, Liquamette model 64, manufactured by American Wheelabrator & Equipment Corp. For precision cleaning and finishing applications involving large pieces, it is 6 ft long by approximately 7 ft deep and 9 ft high. Any number of pieces comprising loads to 3500 lb can be handled. Three sets of armholes accommodate two operators at once, or one operator



in any of three positions. Three individually operated abrasive nozzles incorporate different sized jets for versatility.

52—*Valve eliminates industrial hazards*

Runaway flow rates resulting from line breaks and process upsets are effectively checked by the Sentry balanced diaphragm flow shut-off valve, according to the manufacturer, McRae Valve Corp. The valve permits free process flow at normal pressures, but actuates instantly when regular flow rates are exceeded by unsafe values. Design is said to be such that no pressure drop is introduced into the line. The unit was developed to serve as a safety factor for processes involving hazardous liquids and gases.

53—*Machine is for large scale cleaning*

For large scale cleaning on a mass production scale, the Clayton Kerrick BOE-600S steam cleaning machine is capable of 4 hr continuous operation at maximum load. The unit, developed by Clayton Manufacturing Co., discharges up to 540 gph of pressure detergent spray and 540 gph of hot or cold pressure rinse simultaneously. Kerosene,

fuel oil, distillates or gasoline can be used for fuel. Operation is on 220 v, 60 c, single phase current.

—End

Where dirt, dust and corrosion are a problem...

TYPE E turbines can handle it!

Spencer Chemical Company of Pittsburg, Kansas, has a total of ten 47-hp Type E turbines for driving blowers. Units are mounted outdoors on structural steel and are exposed not only to the elements, but to a corrosive ammonium-nitrate atmosphere.

Continued satisfactory operation of the turbines under these conditions is proof that the Type E can "take it" . . . proof that Type E construction keeps foreign matter out . . . proof that materials used resist corrosion and erosion.

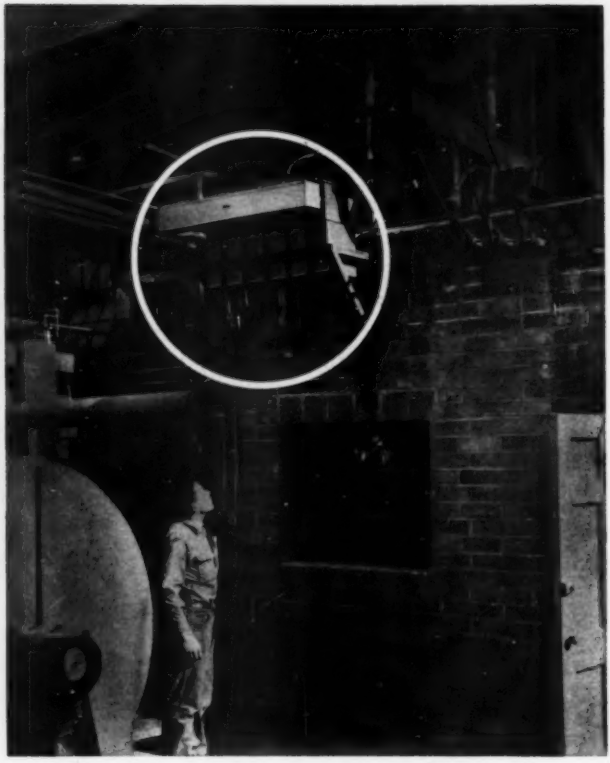
Weather and corrosion resistance are important . . . in the chemical industry and in other industries as well. Important, too, are other Type E features, such as dual protection against overspeed, floating movement of governing and trip linkages, centerline support, parts interchangeability between wheel sizes. Outstanding Type E design assures safe, trouble-free, economical performance for long periods of continuous operation . . . or instant operation when used as a stand-by drive.

Other types in the complete Westinghouse general-purpose turbine line include heavy-duty and multistage units.

Get the facts from your nearby Westinghouse office, or write for twenty-page book B-3896. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-50542

YOU CAN BE SURE...IF IT'S
Westinghouse
TYPE E Turbines

Prevents transformer "burnouts." This 90-kvar, 3-phase, 60-cycle, 460-volt G-E capacitor equipment (circled) helps relieve transformer overloading. Solomon Fingold, Montrose Chemical's electrician, surveys it appreciatively.



Overloaded transformers relieved with G-E Capacitors

Montrose Chemical Corp. of Calif. prevents transformer "burnouts," saves $1800 a year on power costs . . . with $1451 investment.

Rapid postwar expansion put a heavy overload on the transformers that supply power to the Montrose Chemical Corp. of California, located in Los Angeles. Recently, when the overload became critical, the Company sought help. An investigation showed that the plant's power factor was down to 76%—so General Electric engineers recommended the installation of 180 kvar of General Electric capacitors at a cost of $1451.

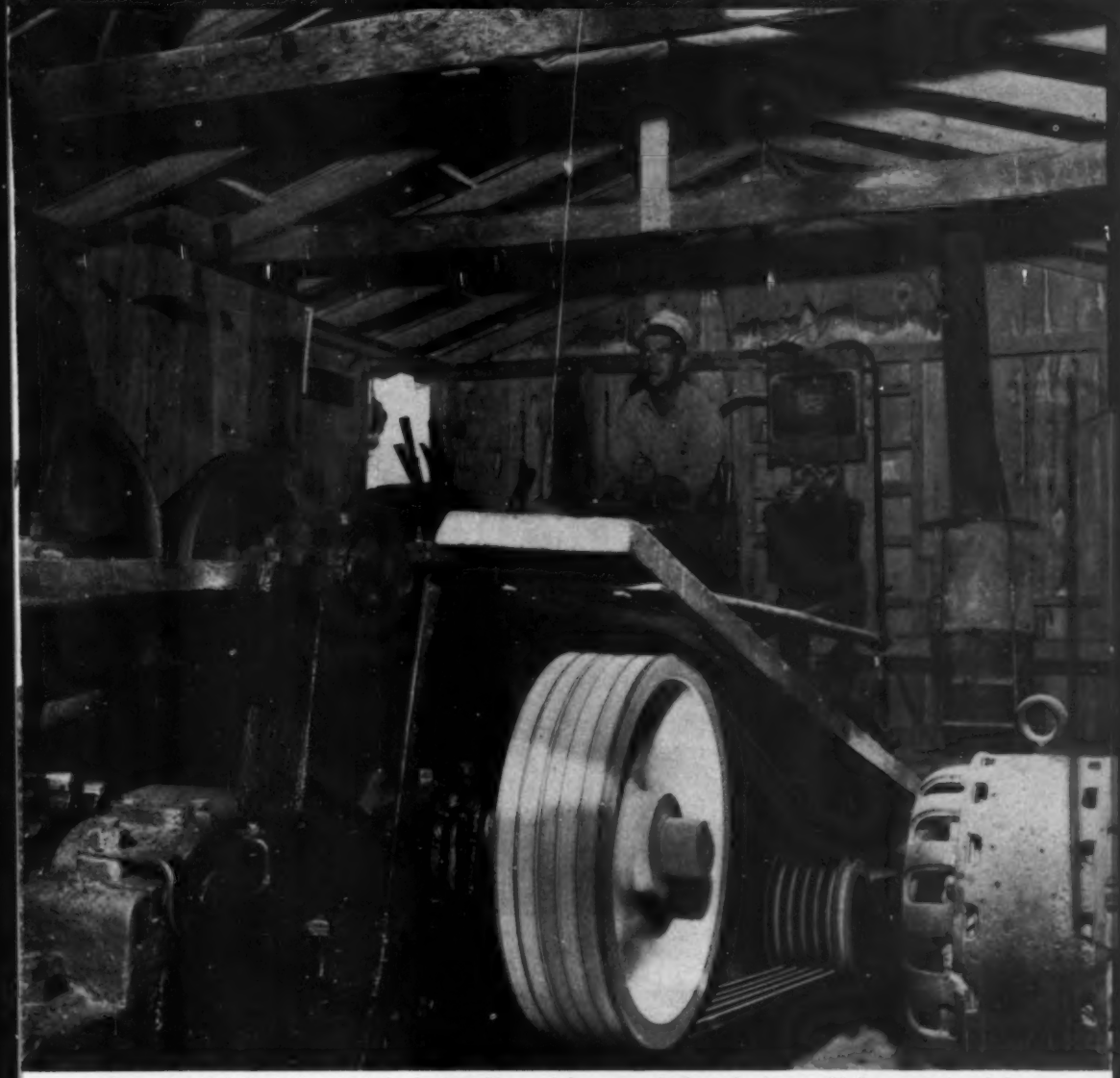
Capacitors improve power factor. Once installed, the capacitors brought the plant's power factor up to better than 97%. This relieved transformer overloading by reducing line current. And since Montrose Chemical had a power-factor clause in its power contract, it also cut power costs by $1800 a year. Thus, the saving on power costs alone will pay for the equipment in less than ten months! *And these savings will go on indefinitely.*

Capacitors provide other benefits, too! Besides releasing transformer capacity, capacitors often permit your present distribution system to carry 20 to 30% more load without added equipment. Where voltage drop is a problem, capacitors can also provide the needed voltage boost inexpensively.

They often hold key to lower power costs. If your power factor is below 85% and if there is a power-factor or kva-demand clause in your power contract, chances are you, too, can make worthwhile savings on your power costs by installing capacitors. For additional information, consult your local G-E Apparatus Sales Office or authorized G-E agent or distributor. Or write to Section 407-210 for Booklet GEA-5632—"How to Use Capacitors to Reduce Power Costs and Gain System Capacity." General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

B.F.Goodrich GROMMET BELTS AT WORK



When a derrick hoisted giant-sized chunks of marble out of the quarry, the heavy loads caused belts to stretch and slip.

Air lift—for giant marbles

That derrick operator has his eye on a 50-ton chunk of marble he's swinging through the air from a quarry to a railroad car. Belts previously used to drive the derrick gave trouble. The heavy loads caused stretching and slipping. It was dangerous and inefficient. An unusual V belt was needed to solve the problem—as you'll see on the following pages.

Air lift (continued)

A motor supplies the power for the 50-ton weight-lifting act—with an assist by the V belts which link motor to hoist.

A BFG distributor solved the problem described on the preceding page when he installed a set of grommet V belts. Grommet V belts are built to handle heavy loads, yet are more flexible, so they don't slip or stretch as much as ordinary belts. In this case, they put an immediate stop to slipping and provided more power to the hoist. Here are some of the reasons grommet belts last longer, serve better, save money.

20 to 50% Longer Life

Patented grommet V belts by B. F. Goodrich represent the only basic improvement since invention of the V belt. Belts last 20 to 50% longer, de-

pending on service. (The more severe the service the greater the increase over ordinary belts.)

What is a grommet?

A grommet is like a giant cable except that it's endless—a cord loop built up by winding heavy cord on itself. There is no overlapping cord *section* as in all ordinary belts. Most belt failures occur in these sections where cords overlap!

All Cords Put To Work

In ordinary belts under high tension the center cords "dish" and tension is greater near the driving faces. Dished cords are doing less work, not pulling their share. Each grommet and every part of a grommet carries its share of the load. Grommet V belts have no center cords—therefore much more strength in proportion to cord volume.

Better Grip, Less Slip

Grommet V belts have more rubber in relation to belt size. Without any stiff overlap, they're more flexible, grip pulleys better. Size for size, grommet belts give ⅓ more gripping power, pull heavier loads with a higher safety factor. Because there is less slip there is also less surface wear.

They Cost No More

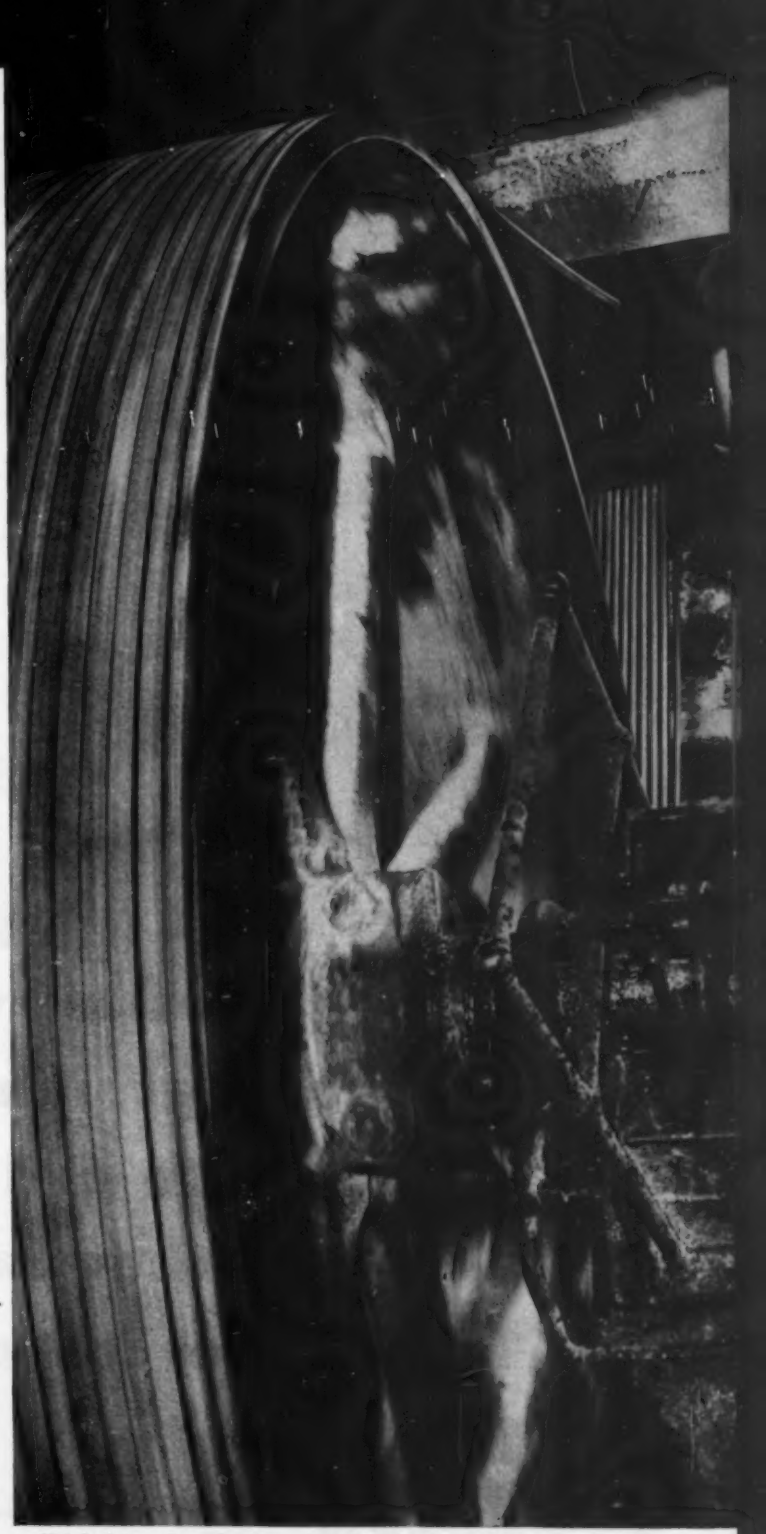
You save belt costs because belts last longer, save production costs because machines keep running with fewer interruptions, save maintenance costs because they need less attention, yet cost not one cent more than others. Grommet belts are made in C, D and E sections. They are patented by B. F. Goodrich. No other V belt is a grommet belt (U. S. Patent No. 2,233,294).

See "X-ray" Belt

A special demonstrator "X-ray" belt has been made to show the grommet construction. Ask your local B. F. Goodrich distributor to show it to you.

Whirl beater

These belts run at top speed all day, supplying power to a pulp beater—one of the first steps in making paper. It's tough service for V belts, but these B. F. Goodrich grommet belts have stood the long hours and heavy loads for three years now, and still look good for years' more service.



V belt drive takes a beating—gives a beating to pulp in this paper mill.

B.F.Goodrich GROMMET BELTS AT WORK

Sure cure for the shakes

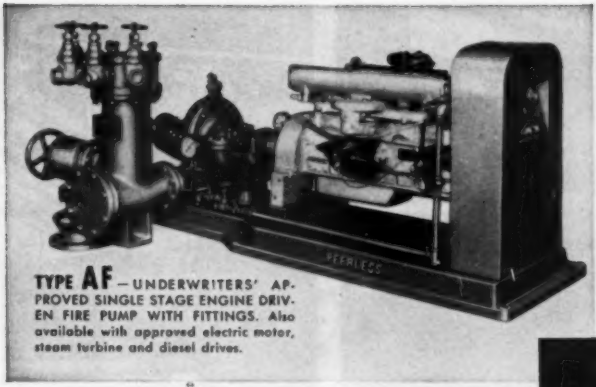
Crushing big rocks not only jolts the crusher, but also puts terrific shock loads on the V belts that drive it. And if the belts can't take the shock treatment—if they should fail—the whole operation shuts down, and rock needed for highway construction is delayed. The stone company wanted reliability—and got it—when a set of B. F. Goodrich grommet V belts was installed. In spite of the shaking, jolting action, the original set of grommet V belts on this crusher has already given two trouble-free years of service, and the belts are still in excellent condition.

Big rocks are crushed into little ones, then used to build highways.

These typical examples (see preceding pages) tell you why B. F. Goodrich grommet belts are superior to ordinary V belts—prove they last 20 to 50% longer—yet cost no more.

Grommet V Belts BY
B.F.Goodrich
FIRST IN RUBBER

The B. F. Goodrich Company, Industrial Products Division, Akron, Ohio

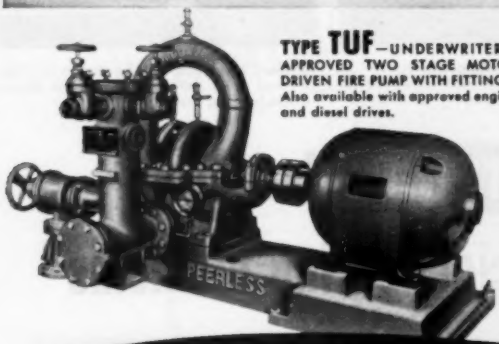


TYPE AF—UNDERWRITERS' APPROVED SINGLE STAGE ENGINE DRIVEN FIRE PUMP WITH FITTINGS. Also available with approved electric motor, steam turbine and diesel drives.

Reliable and Permanent FIRE PROTECTION

FOR EVERY COMMERCIAL AND INDUSTRIAL RISK—

Peerless HORIZONTAL and VERTICAL TURBINE Fire Pumps

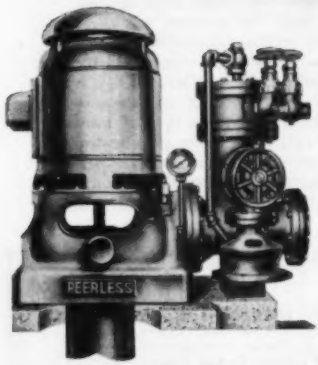


TYPE TUF—UNDERWRITERS' APPROVED TWO STAGE MOTOR DRIVEN FIRE PUMP WITH FITTINGS. Also available with approved engine and diesel drives.

Fully Approved

Both types meet the rigid requirements and regulations of National Board of Fire Underwriters, Underwriters' Laboratories, Chicago, and the Inspection Department of the Associated Factory Mutual Fire Insurance Companies, Boston.

FULLY APPROVED UL FM



PEERLESS PUMPS

VERTICAL TURBINE TYPE—UNDERWRITERS' APPROVED MULTI-STAGE MOTOR DRIVEN FIRE PUMP WITH FITTING. Also available with approved right angle gear drive for stationary engines.

You can place complete confidence in these approved Fire Protection Pumps

Both the Peerless horizontal types (Dayton-Dowd design) and the Peerless vertical turbine type fire pumps are pre-eminent in their field. Because of top quality construction, exacting engineering application and conscientious installation service they offer the best insurance of safety and satisfaction in all risks.

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Peerless bulletins on horizontal type and vertical turbine type fire pumps are most comprehensive. Full engineering and performance data are given on all approved pumps and drivers and accessories. Mail the coupon today for your copies.

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FOOD MACHINERY AND CHEMICAL CORPORATION

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☐ Vertical Turbine Type Fire Pump Bulletin B-152

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IND & POW

Fresh Air is introduced through the sawtooth. Torridor warms this air quickly and delivers it through ductwork.

Employees Stay Warm and draft-free in this production area, warmed by Torridor inverted ceiling type unit.

Torridors Kill Drafts at the doors to this covered track, get warmth right down to the loading dock.

How you can "tailor" TRANE torridors to fit your special heating problems

THINK of a *tough* heating job—where you need a big volume of warmed air. Then take a TRANE Torridor with the needed fan capacity. Add to it the exact amount of heating surface the job calls for, the motor with the right horsepower, the most economical drive, the most efficient controls. Result: you have actually "tailored" this one unit heater to handle your heating job perfectly . . . and it doesn't cost you one cent extra!

That's because TRANE Torridors give you an *unmatched choice* of component parts. You can select from 5 basic models, 10 cabinet sizes and a wide range of motors, filters, controls, dampers and heating coils. Motor or direct drive; 2, 3 or 4 outlets. Thus you can specify the *exact* unit for your job.

And this blower-type unit works almost anywhere. It heats big spaces like assembly areas. It delivers heat to order. It pinpoints large volumes of heat for process work. It works either with or without ductwork. It can introduce outside air, if desired—tempered by famous TRANE Kinetic Orifice coils.

This versatility and freedom of choice is characteristic of the full TRANE line of unit heaters. *Six different types* for every unit heater job. Prompt delivery on current orders. See your nearest TRANE sales engineer or write for Bulletin DS-327A.

TRANE Projection Heater with Louver Cone Diffuser gives 60% greater heat-throw.

TRANE Model H Unit Heater with Louver Fin Diffuser does the work of *two* units.

TRANE Float Trap (shown), Bucket and Thermostatic Traps give perfect results with TRANE Unit Heaters.

TRANE

THE TRANE COMPANY, LA CROSSE, WIS.
Eastern Mfg. Division, Scranton, Pa.
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MANUFACTURING ENGINEERS OF HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT

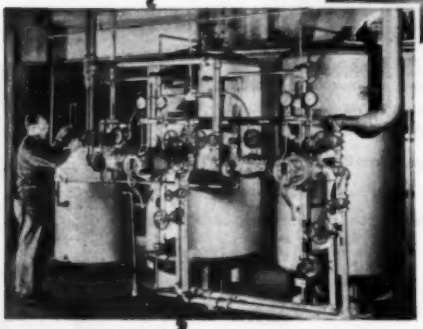
ALLIS-CHALMERS

Water Conditioning

CHEMICALS — EQUIPMENT — SERVICE

FOR WATER *that Fits Your Needs*

This hot process lime-soda softener for treating makeup to high-pressure boilers is rated at 5000 gph.



Sodium zeolite water conditioning equipment with capacity of 130 gpm provides boiler makeup to evaporator in an eastern utility power plant.

Dual automatic sodium zeolite water softener rated at 225 gpm is used in power plant of a Texas hospital.

TO ASSURE YOU water conditioned to your specific requirements, A-C engineers can draw on years of experience treating all types of water . . . plus a broad background of building turbines and processing equipment that are dependent on properly treated water. A-C water conditioning service includes:

Chemicals — for external and internal boiler water treatment . . . designed for silica removal and control of scale, corrosion and carryover. Also cooling cycle treatments . . . and dependable reagent chemicals.

Equipment — hot and cold process softeners . . . sodium and hydrogen zeolite softeners . . . alkalinity-reducing ion exchangers . . . deionizers . . . degasifiers . . . deaerating heaters . . . chemical feeding equipment . . . pumps . . . oil removal and water filters.

Comprehensive consultant service — surveys, reports . . . chemical and X-ray analysis . . . special studies.

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28X7636 — Meaning, Application and Measurement of pH

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2886611 — Hot Process Softener

2887107 — Sodium Zeolite Softener

28X7808 — Alkalinity-Reducing Ion Exchanger

ALLIS-CHALMERS

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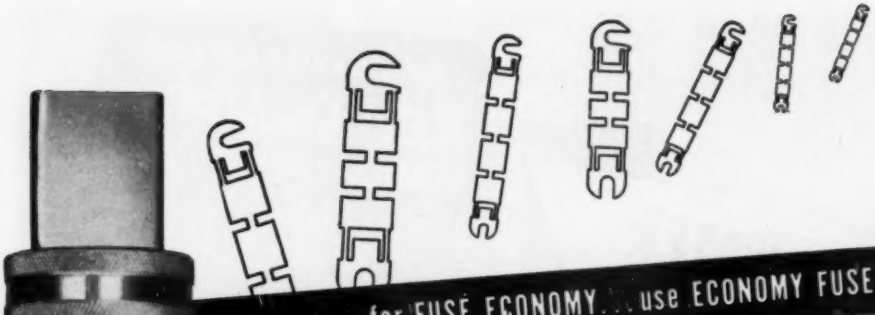
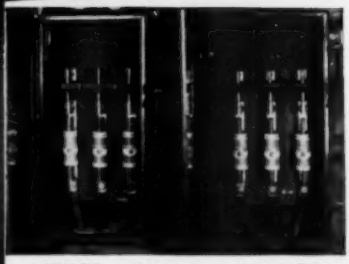
Milwaukee 1, Wisconsin



for FUSE ECONOMY . . . use ECONOMY FUSES



YOU SAVE 3 WAYS!

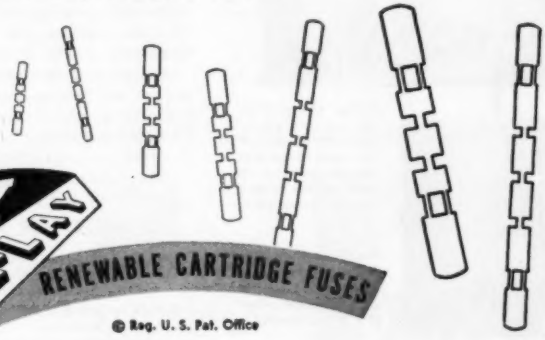
FIRST—with "ECONOMY DE-LAY" Renewable Fuses you save money every time you have a current "blow". Simply remove the blown link and replace it at the cost of only a few cents with a new, "ECONOMY DE-LAY" Renewal Link in the same cartridge.

SECOND—you save because of the short time required to make this replacement—and time is money.

THIRD—you save by reducing "down time" on machines—because an inexpensive carton of Economy Fuse Renewal Links kept on hand 24 hours a day, answers fuse renewal requirements *immediately*.

Your Electrical Wholesaler has "ECONOMY DE-LAY" Renewable Fuses and Renewal Links in stock.

Ask for the Economy Catalog and Price List.



ECONOMY DE-LAY RENEWABLE CARTRIDGE FUSES

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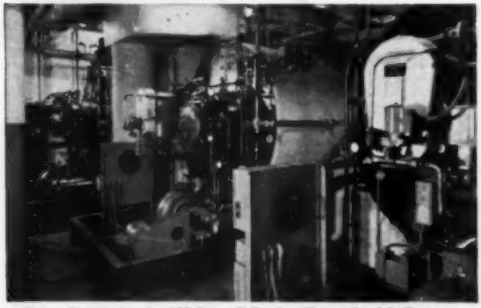
ECONOMY FUSE AND MFG. CO., 2717 GREENVIEW AVE., CHICAGO 14, ILLINOIS REPRESENTATIVES IN ALL PRINCIPAL CITIES

6720

In this modern newspaper building passersby can see running presses through 11 ft. plate glass windows, located directly behind flag pole in this picture.

WASHINGTON POST BUILDING, Washington, D. C. Albert Kahn Associated Architects and Engineers, Inc. John McShain, Inc. — General Contractor. Standard Engineering Company, Engineers and Contractors.

THE WASHINGTON POST'S new 7-story building is heated by a combination of a hot blast ventilating system for the inside areas and convector radiation along the outside walls. The steam distribution system is divided into two sections, one supplying the fan blast coils at 3 lbs. to 5 lbs. pressure and one supplying the radiation at 3 lbs. to 5 lbs. pressure.



Three Cleaver-Brooks 150 hp., oil-fired, self-contained boilers were easily and quickly installed in low headroom, basement space.

Three Cleaver-Brooks 150 hp. oil-fired, self-contained boilers, installed in the basement location, supply steam for the entire heating system.

Modern Cleaver-Brooks boilers are increasingly specified for heating service. Completely self-contained and compact in design, requiring minimum headroom and floor area, Cleaver-Brooks boilers offer many installation and operating advantages — oil, gas, or combination oil and gas firing — fully automatic — clean — dependable performance — operate at a guaranteed efficiency of 80%. Available in sizes from 15 to 500 hp., 15 to 250 psi.

Write for the latest, fully illustrated Steam Boiler Catalog — Cleaver-Brooks Company, Dept. M, 302 East Keefe Avenue, Milwaukee 12, Wisconsin, U.S.A. *Cable address*: CLEBRO-Milwaukeewis.

Cleaver-Brooks
Originators of Self-Contained
STEAM BOILERS

Oil and Bitumen Tank-Car Heaters • Distillation Equipment • Oil and Gas-Fired Conversion Burners

Corrosion of piping in steam and condensate return lines is an expensive two-way headache. (1) It leads to large outlays for pipe replacement and maintenance. (2) It often results in plugged return lines and traps due to the solid products of corrosion. Bird-Archer Amine Treatment effectively eliminates these troubles at low cost.

Here's how. Amines are fed into the boiler or into the steam and condensate systems. The amines raise the pH value of the condensate and also tend to inhibit equipment-destroying corrosion through surface protection of the metal itself. In scores of plants, this Bird-Archer system has more than paid for itself by substantially cutting replacement and maintenance costs.

Bulletin CP 100 gives all the facts on Bird-Archer Amine Treatment. Write for your copy.

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WATER TREATMENT

THE BIRD-ARCHER COMPANY, 4337 NORTH AMERICAN ST., PHILADELPHIA 40, PA.
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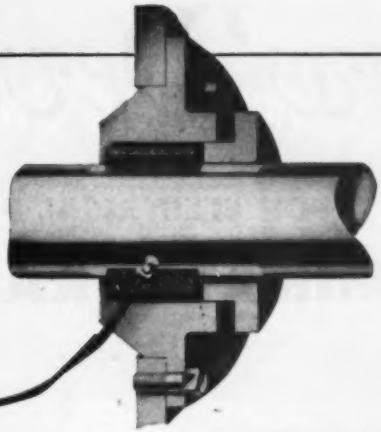
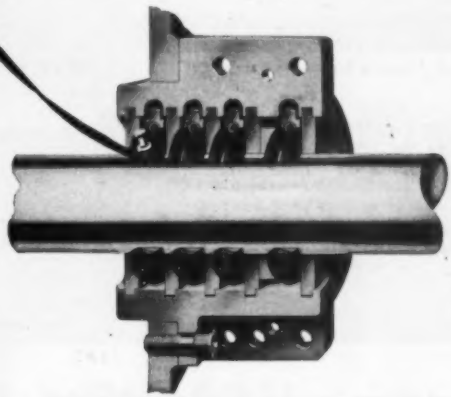
BA 100

COPPUS TURBINES

offer you a choice of packing rings



STANDARD METALLIC RING PACKING — Made of high grade asbestos cores encased in specially treated lubricated aluminum foil. Recommended as a low-friction, long-service packing for steam temperatures up to 850 F and back pressures up to 50 lb. Adjustable packing glands keep leakage at minimum. Easy access to packing rings.



OPTIONAL CARBON RING PACKING — Consists of three carbon packing rings on the pressure side and one beyond the leak-off section. Each ring has three segments held together by a stainless steel garter spring. For back pressures up to 75 lb. Standard for vacuum or gas operation, or when leak-off is desired.

Heavy chrome plating on shaft at stuffing box is common to both types of Coppus packing.

Coppus Turbines ranging from 150 hp down to fractional in 6 frame sizes

FIT TURBINE COSTS TO HORSEPOWER NEEDS

When you buy turbines rated close to your exact horsepower needs, you save plenty of money. That's because turbines are generally priced in proportion to their size. The wide range of sizes of Coppus Turbines promises purchasing economy for you from the 150 hp size down to the smallest. As for operating and maintenance economies, you get them, too, from such other features as: greater number of manually operated valves for individual control of steam nozzles; replaceable cartridge-type bearing housings and others. For complete details . . .

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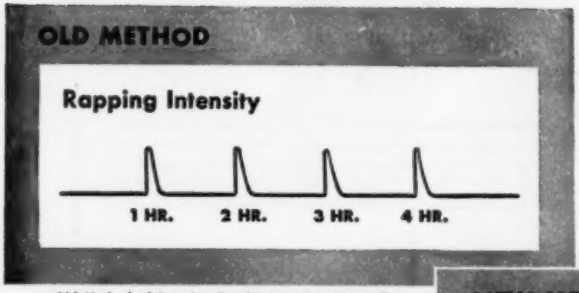
COPPUS "BLUE RIBBON" TURBINES

New Development

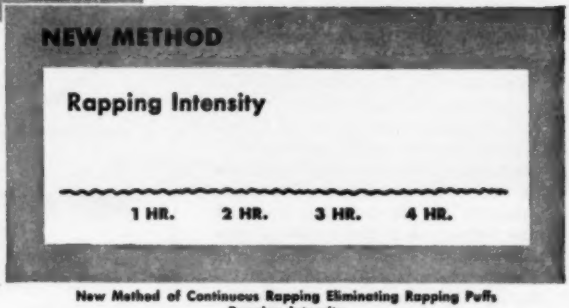
FOR ELECTRICAL PRECIPITATORS

ELIMINATES RAPPING PUFFS



Old Method of Rapping Resulting in Rapping Puff

Here are two simple diagrams that clearly demonstrate the importance of the new method of rapping developed by Research Corporation. The first shows the old way in which dust is shaken loose from electrodes at *periodic* intervals, causing intermittent puffs or clouding.



New Method of Continuous Rapping Eliminating Rapping Puffs
Rapping Intensity

This second diagram illustrates the new scientific method of cleaning electrodes. It involves continuous or sequential rapping, every minute or less, at a controlled vibrational intensity. This converts precipitation from a batch operation to a *continuous and uniform process.*

This is another major contribution by Research Corporation to the field of electrical precipitation. Constant research and development work for the past 39 years has resulted in many other improvements over the first Cottrell Precipitator. These advances plus the unequaled experience gained through over 1000 installations, listed at right, assure you of a profitable solution to your specific problem.

RESEARCH CORPORATION INSTALLATIONS

55 Carbon Black Plants
208 Metallurgical Installations
215 Acid Plants • 34 Paper Mills
293 Detarring Installations
251 Power Stations
86 Steel Plants • 114 Oil Refineries
and Miscellaneous Installations

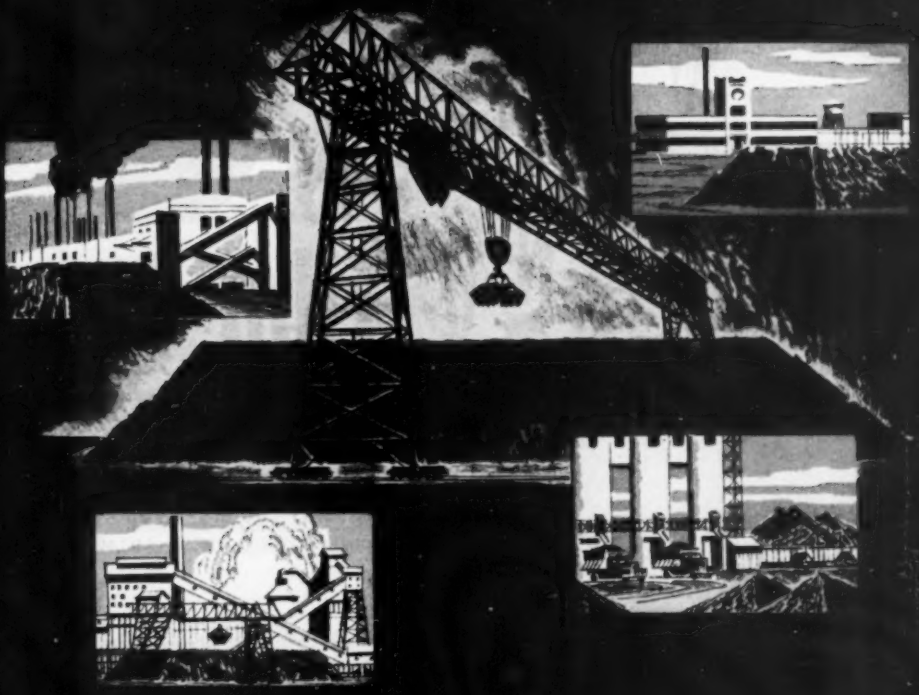
Want to know more about the new Rapping System? Bulletin FA contains additional data. Send for your copy.

RESEARCH CORPORATION

405 Lexington Avenue, New York 17, N. Y.
122 South Michigan Avenue, Chicago 3, Illinois
Bound Brook, New Jersey

RC-129

tomorrow's fuel supply



BEACON COAL

EASTERN GAS AND FUEL ASSOCIATES

PITTSBURGH • BOSTON • CHICAGO • CLEVELAND • DETROIT
NEW YORK • NORFOLK • PHILADELPHIA • SYRACUSE

For New England:
New England Coal & Coke Co.

For Export:
Cortner, Curran & Bullitt, Inc.

EASTERN GAS AND FUEL ASSOCIATES

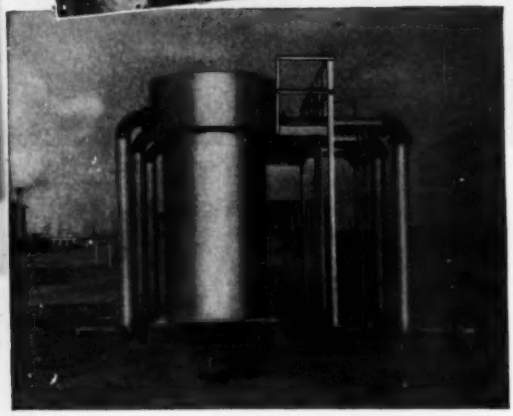
Dirty Water can't "Shut-down"...

Vogt

film type exchangers

(Condensers—Coolers—Evaporators)

Patent Nos. 1,935,270 - 2,057,597 - 2,424,441



River water, well water or brackish water are all alike to this exchanger *because it can be cleaned* while in operation! The water distributing ferrules need only be removed successively for the cleaning brush or tool whereby the tubes receive additional water which sluices away the dislodged dirt.

Vogt Film Type Exchangers are operating with real economy of first cost, operation and maintenance in power, petroleum, and chemical industries. They serve as Jacket Water Coolers, Feed Water Heaters, Hydrocarbon Evaporators, Sulphuric Acid Coolers, and Sulphur Dioxide Condensers, and can be designed to cool or heat any liquid and to condense or evaporate any fluid.

TOP: *Four units at Newton Falls, Ohio Municipal plant cool water for diesel engines and a lubricating oil cooler.*

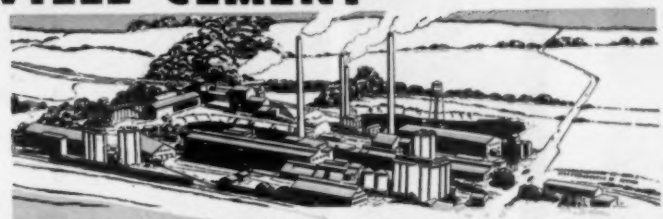
BOTTOM: *Jacket Water Coolers serving engines of 7,300 HP in the compression plant of a Western Oil Refinery.*

[Bulletin HE-7 describes typical installations of Vogt Film Type exchangers and is available upon request.]

HENRY VOGT MACHINE CO., LOUISVILLE, KY.

Branch Offices: NEW YORK, CHICAGO, CLEVELAND, DALLAS, PHILADELPHIA, ST. LOUIS, CHARLESTON, W. VA.

LOUISVILLE CEMENT



Recently expanded and modernized mills of Louisville Cement Co., located in Speed, Indiana.

Louisville Cement Co.'s, nationally known Speed Portland Cement, Hi-Speed, high early strength cement and Brixment masonry cement are products of strict adherence to high standards of quality and utmost efficiency in production.

Modern Sunlight Mine in Indiana; typical of Southern's extensive coal operations.

SOUTHERN'S VERSATILE COAL SERVICE EFFECTS FUEL SAVINGS THAT HELP LOWER LOUISVILLE'S PRODUCTION COST

Southern's ability to apply a coal of consistent uniformity to Louisville's kiln firing and intense heat producing requirements is an important contributing factor in reducing over-all production costs. Precision prepared coal from Southern's Sunlight mine continuously meets these rigid burning specifications through dependable daily performance.

You also may effect substantial fuel and production economies by doing business with Southern.

You have the advantages of wide selection, dependable supply. Southern's big producing mines in Indiana, Western Kentucky, Ohio and Illinois are favorably located to serve you—10,000,000 tons annual capacity . . . In modern preparation plants, processing operations are rigidly controlled. Coals are washed, precision sized, graded and laboratory tested daily—engineered to strictest industrial specifications for quality and uniformity.

Learn more about how you can lower your steam and production costs. Your nearest Southern office will gladly submit recommendations and proposals applied to your specific burning requirements.

YOU CAN RELY ON SOUTHERN'S ENGINEERED INDUSTRIAL COALS

Southern Coal Company, Inc.

GENERAL OFFICE: 333 North Michigan Avenue, Chicago 1, Illinois
OFFICES IN: Louisville, Memphis, Nashville, St. Louis
Sinclair Coal Company, Kansas City, Mo., Western Representative

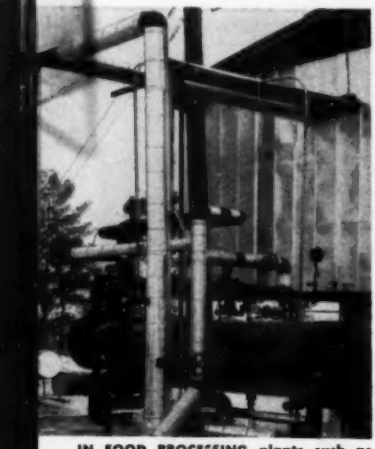
IN PETROLEUM REFINERIES like this a new kind of aluminum jacketing is used to protect the insulation on hot and cold lines. It is known as Childers Aluminum Jacketing and is especially engineered to combine the long life and weather resistance of aluminum with a low first cost. It goes on quick and easy—can be used and re-used. It is made of tough but flexible .006" 35 aluminum alloy, so it handles easily and requires no shop forming.

IN CHEMICAL AND PAPER plants: engineers are finding new uses for this easy-to-handle jacketing. Childers Jacketing here is in use at Scott Paper Company's tremendous Chester, Pa., plant. The insulated line passes between fast moving rolls carrying the felt used in paper making both above and below the line. The Aluminum Jacketing protects against paper dust and water, both of which are always present in the manufacture of paper. The jacketing also appreciably diminishes the possibility of the spread of fire which might strike across ordinary canvas jacketing.

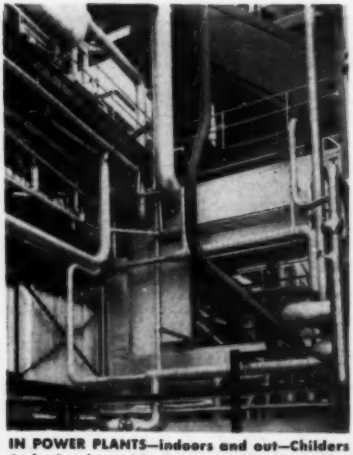
Engineered for outdoor lines — new, low-cost aluminum jacketing now used in 567 processing plants

The new kind of aluminum jacketing for insulated lines shown in the pictures on this page is Childers Aluminum Weatherproof Jacketing. Write for samples and full details, no obligation. Childers Manufacturing Co., Dept. YP-4, 3620 W. 11th St., Houston 8, Texas.

Under CMP regulations, Childers is a Class B product, the use of which is not restricted.



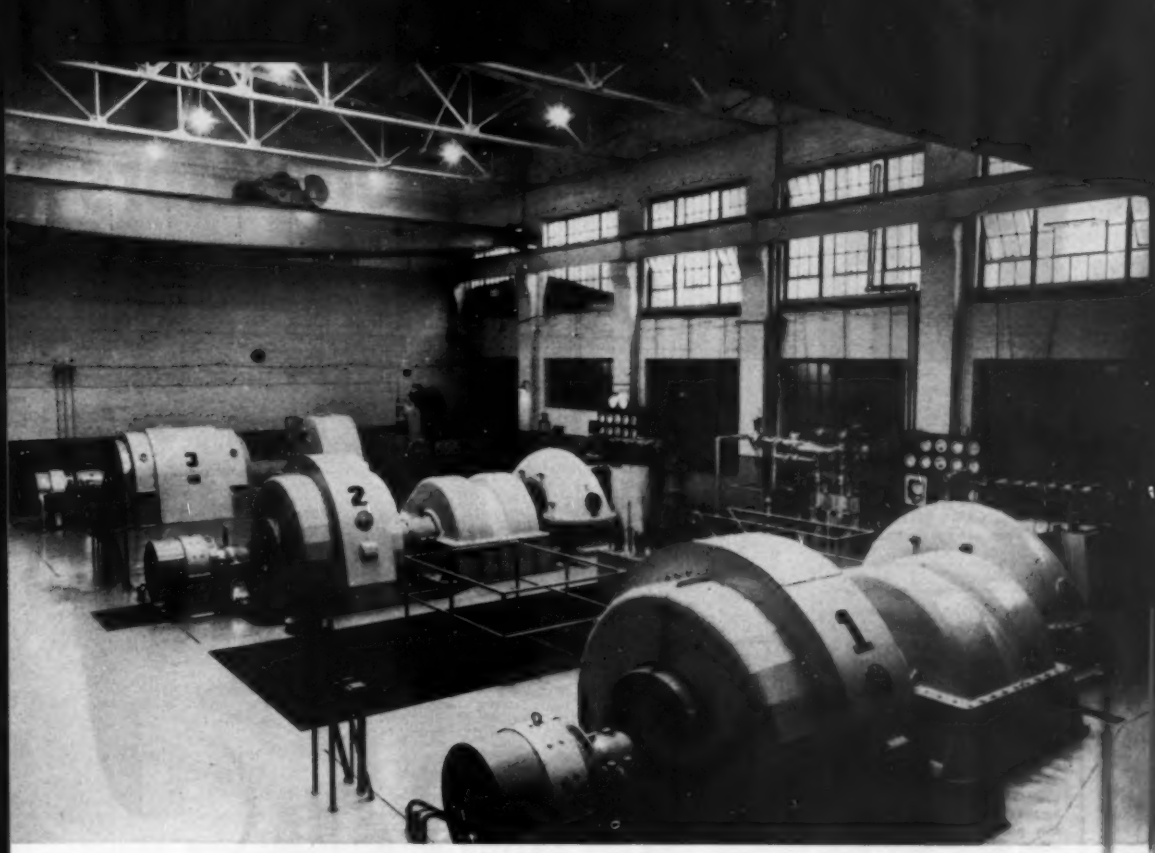
IN FOOD PROCESSING plants such as this Minute Maid Corp. unit at Plymouth, Fla., Childers Jacketing is useful for both indoor and outdoor installations. Its clean, shining appearance and ease of washing are extra advantages.



IN POWER PLANTS—indoors and out—Childers Jacketing is an ideal material for protecting insulation. This is a big outdoor installation in the South. This jacketing needs no painting, and the gleaming aluminum surface makes for "good housekeeping" in any utility or institutional power station.

ALMOST ANYWHERE you have insulated lines in your processing plant, consider this specially engineered jacketing. It is flexible, easy-to-handle; yet it has the appearance values and the weather resistance that are inherent in aluminum. Write to address shown above for full details.

Advertisement



17-year record shows savings you can make with...

NONPAREIL
TRADE MARK
Turbine Oil

• Turbine oil changed every three years, oil systems cleaned every year, filters cleaned every four months . . . that was the oil system maintenance routine in the power plant of a mid-west paper mill before the switch was made to NONPAREIL Turbine Oil.

Recommended by a Standard Oil lubrication specialist, NONPAREIL has been used for 17 years in the plant's two 4,000-KW units and for 12 years in its 5,000-KW unit. The original fills of oil have never been removed from the turbines. Neutralization numbers have remained below 0.09 mg. KOH/gm. The oil systems have never needed cleaning.

While the lubricant and maintenance savings already realized by this power plant are impressive, they are just a beginning. Trouble-free lubrication and consequent savings are *assured for the life of these turbines.* This is based on the written guarantee, given with each fill of NONPAREIL, that this unique lubricant will last as long as the turbine, and that its neutralization number will stay below 0.15 mg. KOH/gm.

A Standard Oil lubrication specialist will be glad to show you record after record, each covering over 20 years' operation, where NONPAREIL has eliminated oil replacements, oil system cleaning, and troubles caused by excessive oil acidity. All you need do is phone your local Standard Oil (Indiana) office. Or, write Standard Oil Company, 910 South Michigan Ave., Chicago 80, Illinois.

STANDARD OIL COMPANY
(Indiana)

SO

STANDARD

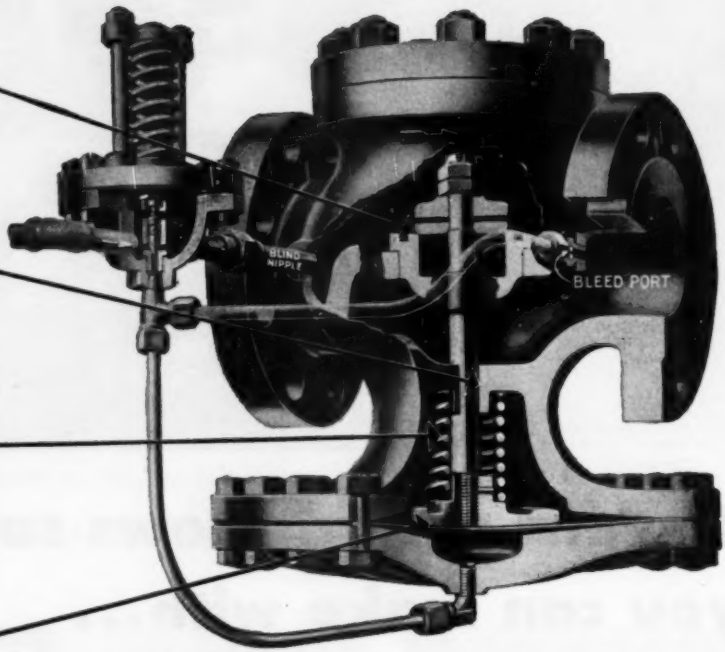
WHY Spence Regulators Outlast The Field

SECO METAL SEATS AND DISCS — Durable SECO Metal resists wiredrawing. More than *twenty years of experience* in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

PACKLESS CONSTRUCTION — All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

SPRING OUT OF PATH OF STEAM — The spring in the Spence Regulator is out of the path of the steam or other fluid flowing through the valve. It operates at low unit stress for exceptionally long life.

LARGE BALANCED DIAPHRAGM—Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.



Spence Type EQ back pressure regulator — operation of main valve is controlled by a sensitive pilot to regulate the initial pressure. Same pilot is used with all sizes of main valves.

The features shown above explain why you profit on every important count with Spence Pressure and Temperature Regulators.

Learn more about these and many other advantages of Spence Regulators by sending for Bulletin 350.

DURABILITY — Spence Regulators perform dependably year after year.

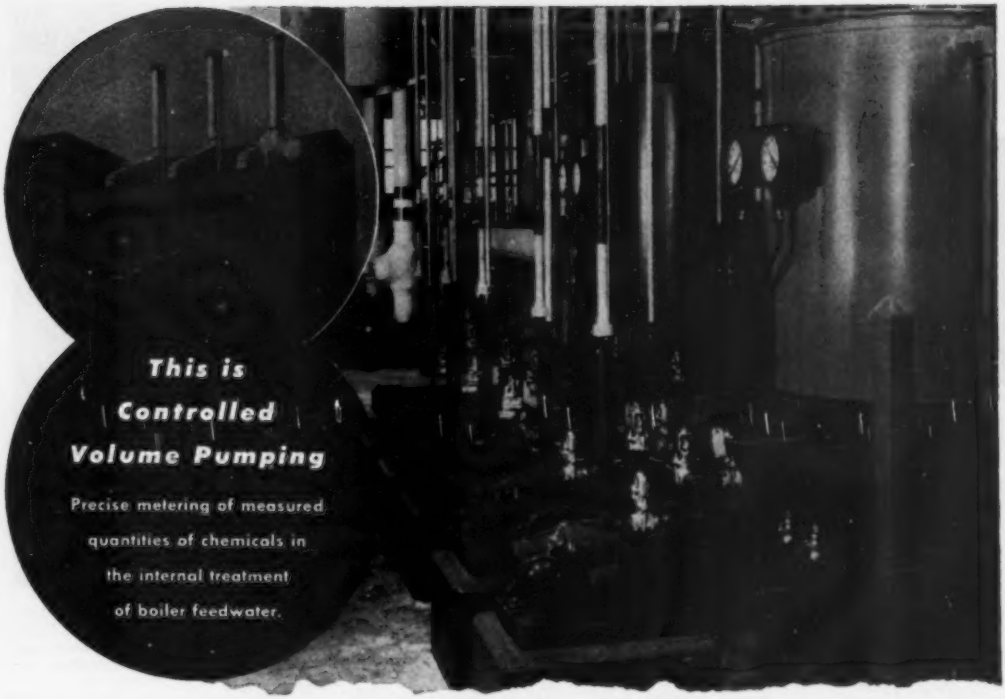
ACCURACY — You can be sure of accurate control for the life of the regulator.

MAINTENANCE — You don't need expensive repairs or special maintenance. That means less down-time, less time and money wasted on replacement of parts.

BB-110

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

Spence


This is
Controlled
Volume Pumping
Precise metering of measured quantities of chemicals in the internal treatment of boiler feedwater.

THESE MILTON ROY CONTROLLED VOLUME PUMPS DO THE JOB . . .

The modern Beloit, Wisconsin steam generating plant of Fairbanks, Morse & Co., manufacturers of diesel engines, locomotives, generators, pumps, motors and magnetos, is designed to handle heavy processing loads and plant heating. To help maintain the continuity of service so vital to power plant operation, company engineers placed emphasis on methods of preventing corrosion and other destructive conditions in the boiler feedwater system. Five Milton Roy Controlled Volume Simplex Pumps are employed to meter precise quantities of chemicals into the boiler feedwater: disodium phosphate for residual water hardness in the boiler drums; sodium sulphite for oxygen removal in the deaerator and feed lines; organics for prevention of precipitation in economizer and feed line; alkalene polyamide as anti-foam for reduction of surface tension; octadecylamine for steam and return line corrosion. Fairbanks, Morse & Co. specified Milton Roy Controlled Volume Pumps because of their metering accuracy, service dependability, positive and flexible control, low maintenance.

Boiler feedwater treatment is only one of many applications of Milton Roy Controlled Volume Pumps. They're also used in all forms of internal and external feed systems, including introduction of chemicals directly to boiler drums, intermittent feeding followed by condensate flushing, automatic chemical injection in ratio to flow, automatic pH control, and automatic control by conductivity.

These versatile pumps offer positive, precision control and metering of chemicals at any pressure requirements. As air-powered or motor-driven units or as components of automatic systems, Milton Roy pumps ensure utmost accuracy.

For additional information on Milton Roy Controlled Volume Pumps and Automatic Chemical Feed Systems, call the Milton Roy field representatives listed in your classified telephone directory. Or get in touch with us.

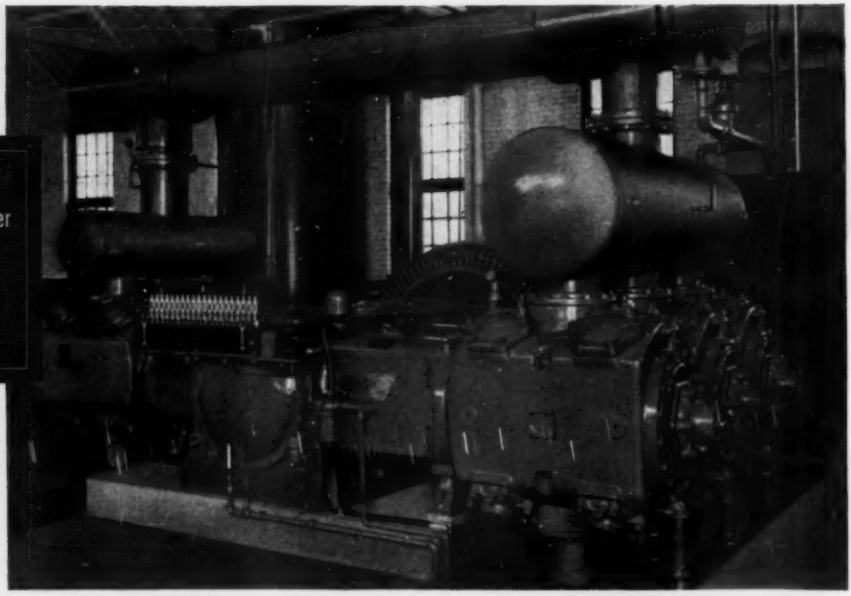
Manufacturing Engineers

WITH THE EXCLUSIVE STEP VALVE DESIGN

MILTON Roy COMPANY

1319 EAST MERMAID LANE, PHILADELPHIA 18, PA.

CONTROLLED VOLUME PUMPS AND AUTOMATIC CHEMICAL FEED SYSTEMS



Recently installed in Newark Stove Company plant, Newark, Ohio, this is a Cooper-Bessemer 800 hp Type FM compressor with 5 balanced-opposed compressor cylinders.

Why Air Costs Less at Newark Stove

Add up the advantages of this modern-type Cooper-Bessemer compressor, and you'll see why it does a *low*-cost job, year in, year out.

For example, with balanced, opposed action, it's the smoothest running compressor money can buy . . . and that means continuous, vibration-free operation with less repair, less maintenance.

For another thing, Cooper-Bessemer design offers unusual compactness. Foundation and piping requirements are correspondingly less. No need for a deep motor pit.

But check up further. Look into the many construction features, found only in Cooper-Bessemers, that are your *best* guarantee of permanent satisfaction.

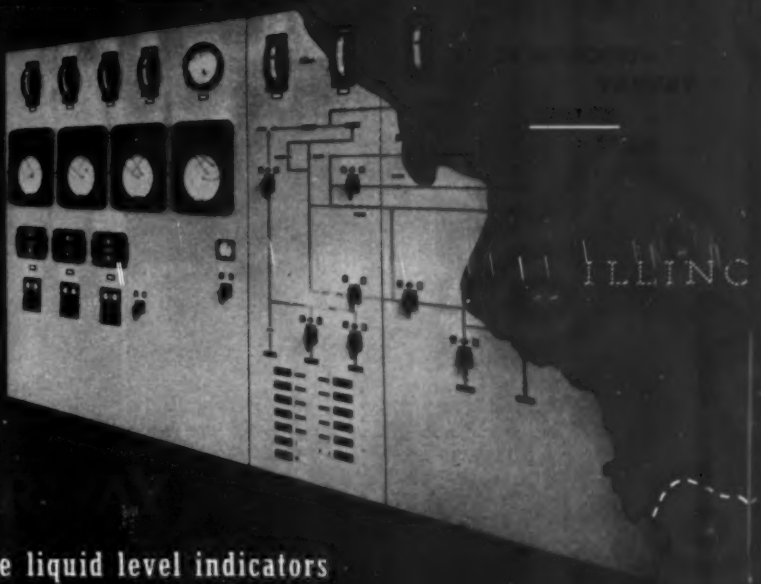
SEND FOR THIS BULLETIN . . . it gives details and pertinent data on the Cooper-Bessemer power-driven Type M compressors, 350 to 1,000 bhp.

The Cooper-Bessemer Corporation

MOUNT VERNON, OHIO — GROVE CITY, PENNA.

New York Washington, D. C. Bradford, Pa. San Francisco Houston, Dallas, Greggton, Pampa and Odessa, Texas Seattle Tulsa Shreveport St. Louis Los Angeles Chicago Caracas, Venezuela Cooper-Bessemer of Canada, Ltd., Halifax, Nova Scotia Gloucester, Mass. New Orleans, La.

The Empire District Electric Company orders and reorders...



remote liquid level indicators

YARWAY SERVICE GOES ALL THE WAY...

here's a complete WATER WORKS in a small package...

JBAS

for:

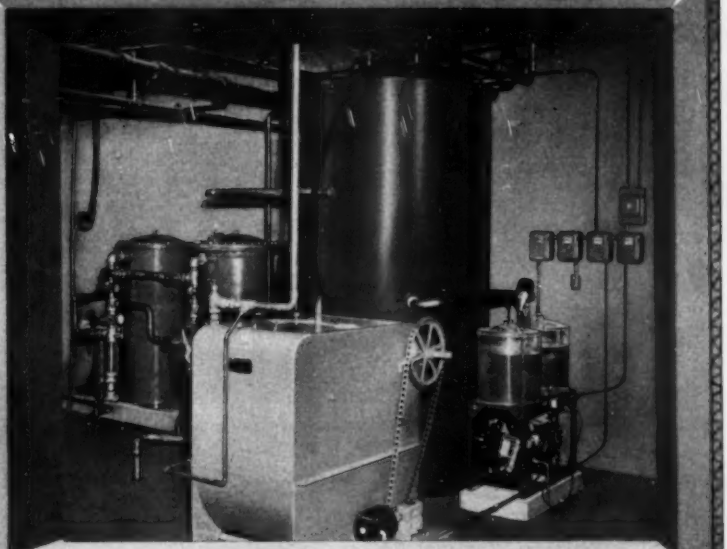
FIELD CREW DRINKING SUPPLY

ENGINE COOLING

BOILER FEED

SMALL DOMESTIC SUPPLIES

CHEMICAL AND MANUFACTURING PROCESS



FOR THE MANY USES OF TREATED WATER, INFILCO ENGINEERS THE JBAS ACCELATOR

The JBAS doesn't care if your source of water is creek, river, lake or well. It is equally effective for softening, clarifying, sterilizing, or removing organic matter, tastes, or odors. Its versatility has been demonstrated in hundreds of installations treating 5 to 100 gallons per minute, providing a water equal or superior to large municipal supplies.

Ask for Bulletin 1845

and see how a JBAS conserves space and installation costs. Learn how and why JBAS gives uniformly satisfactory results with minimum supervision and attention. Note it can be readily moved, too, if necessary.

INFILCO

• BETTER WATER CONDITIONING • AND WASTE TREATMENT SINCE 1914

INFILCO INC. *Tucson, Arizona* | *Plants in Chicago & Joliet, Illinois*

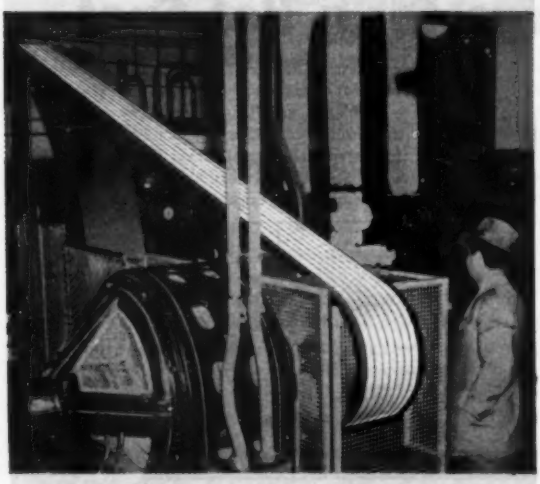
FIELD ENGINEERING OFFICES IN 26 PRINCIPAL CITIES

How concave sides cut V-Belt costs

Important to anyone who wants to cut V-Belt replacement costs is the simple, interesting reason WHY Gates Vulco Ropes are built with *Concave Sides* (U. S. Patent 1813698). See Figure 1.

When a Gates belt is bent around a sheave these Concave Sides fill out to full, even contact with the sides of the sheave groove. (Figure 1A). This gives you sure pulling power. And, naturally, because wear is distributed evenly, the Concave Sides actually give you longer wear—longer belt life. That cuts V-Belt replacement costs.

On the other hand, when a straight sided V-Belt (Figure 2) is bent, the sides bulge out, preventing the belt from fitting evenly in the sheave groove. This causes *extra wear* at the points shown by arrows. (Figure 2A).



Make this simple test yourself...

Hold a straight sided V-Belt as it would be bent around a sheave. Take the sides of the belt between your finger and thumb. You can *feel* the bulges in the sides—the bulges that prevent an even fit in the sheave groove and cause extra wear.

Now do the same thing with a Gates Vulco Rope. You can feel the sides fill out. You can see why they press firmly and evenly against the sides of the sheave groove—giving you longer belt life—lower belt costs.

When you buy V-Belts be sure to get Gates Vulco Ropes—the V-Belts with the Concave Sides.

Gates Engineering Offices and Jobber Stocks are located in all industrial centers of the United States and in 71 foreign countries.

SAVING $1,000 A YEAR

This big 18 foot flywheel on an ammonia compressor at the Terminal Warehouse Co., St. Joseph, Missouri, was originally driven by a flat belt.

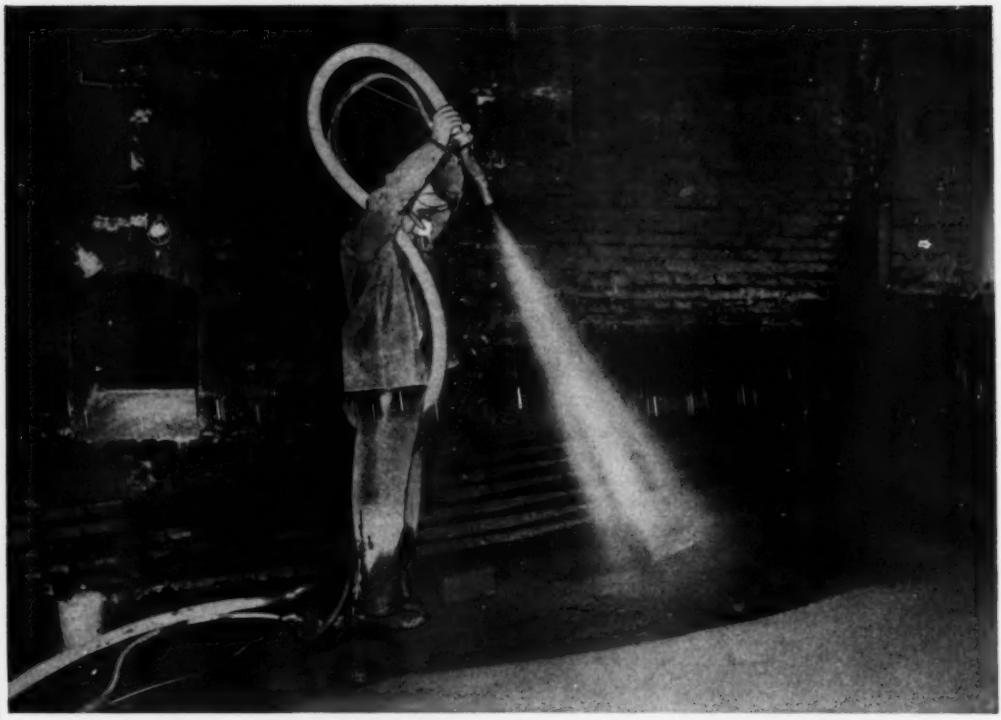
Mr. I. McKee, plant superintendent says, "We needed a drive we could depend on, so we installed a Gates Vulco Rope drive right on the flat pulley of the compressor. This conversion is saving us about $1,000 a year."

CS-526-A

Gates® VULCO ROPE DRIVES

THE GATES RUBBER COMPANY • DENVER, U.S.A.

V-Belts — Hose
Molded Rubber Goods
for Industry
World's Largest Maker
of V-Belts



Consolidated Edison finds refractory concrete gives

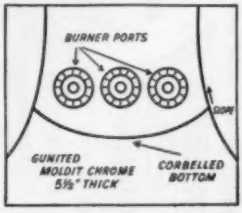
Low Cover Charge for a Hot Spot

THE FLOOR OF THIS BIG BOILER is literally one of the hottest places in town. Day in and day out it takes terrific punishment as it is baked by flame at temperatures of 2750° to 2800°F. For economy, New York's Consolidated Edison Company tops the floor with 5½ inches of durable refractory concrete. And they save dollars and days from the start!

A castable refractory mix of Lumnite calcium-aluminate cement and aggregate is simply "shot" on by cement gun and reaches service strength in 24 hours or less . . . cutting costly outage.

In service, refractory concrete takes high temperatures and has low volume change to withstand thermal shock. It has excellent abrasion and corrosion resistance as well. So convinced is Consolidated Edison of the economy of refractory concrete that their plans call for building 17 boiler floors this way!

WHEREVER heat, abrasion, corrosion or thermal shock are problems, you'll find refractory concrete made with Lumnite cement a wise choice. For more information, write Universal Atlas Cement Company, (United States Steel Corporation Subsidiary), 100 Park Avenue, New York 17, N. Y.



Refractory concrete for boiler floor is made with Refractory and Insulation Corporation Moldit Chrome Castable, one of the ready-prepared castable mixes of Lumnite cement and aggregate for specific temperature and insulation service available through manufacturers and their distributors. To use—add only water.

**"LUMNITE" is the registered trade mark of the calcium-aluminate cement manufactured by Universal Atlas Cement Company.*

IP-L-72

ATLAS® **LUMNITE for INDUSTRIAL CONCRETES**

REFRACTORY, INSULATING, OVERNIGHT, CORROSION-RESISTANT

"THE THEATRE GUILD ON THE AIR"—*Sponsored by U. S. Steel Subsidiaries—Sunday Evenings—NBC Network*

the Erie City "VC"

A 2-DRUM Steam Generator with complete furnace cooling

A 50 year experience with 2-drum boilers is reflected in this modern design. Today's ERIE CITY "VC" incorporates scores of design, manufacturing and installation improvements. The Erie City "VC", as described in our latest catalog, offers high capacity in a compact design which saves space — lowers installation and maintenance costs and assures good operating characteristics with a wide choice of fuels and firing methods. New Catalog VC-3 describes the Erie City modern 2-drum Steam Generator in detail.

You can depend on Erie City for sound engineering

ERIE CITY
112 Years in Steam Generation

ERIE CITY IRON WORKS • *Erie, Pa.*

STEAM GENERATORS • SUPERHEATERS • ECONOMIZERS • AIR PREHEATERS
UNDERFEED AND SPREADER STOKERS • PULVERIZERS

How to make packings last longer

Tips by Johns-Manville Engineers to help you keep production rolling

...and this new chart makes it easy to choose the right J-M Packings for your power plant equipment

A handy 6-page guide, "Johns-Manville Packings for the Power Plant" simplifies the selection and application of power plant packings. Covering 32 of our most popular styles, it tells at a glance what J-M packings to use... why they are recommended... and how to install them.

Its schematic diagram is spot-keyed to help you locate packing styles for various equipment units. Its brief group-headings help you select J-M packings for centrifugal and rotary services, reciprocating rods and plungers, valve stems, pipe flanges, manholes and handholes... to seal against steam, water, oil, brine, etc.... to withstand various temperatures and pressures. Its condensed packing descriptions give you essential buying information.

And a page is devoted to tips on proper installation to help you get maximum economy and efficiency from your Johns-Manville packings.

Your local Johns-Manville Packing Distributor will be glad to give you a copy of this handy packing selector, free of charge. Or write to Johns-Manville, Box 60, New York 16, N. Y., asking for Brochure PK-61A. In Canada, address 199 Bay Street, Toronto 1, Ontario.

JOHNS-MANVILLE PRODUCTS

Johns-Manville PACKINGS & GASKETS

Stopping Rust with RUST-OLEUM 769 D.P. Red Primer

RUST-OLEUM

Look for this label. Be sure it's genuine RUST-OLEUM!

All Colors, Aluminum and White— Beautifies As It Protects!

This practical coating may be applied directly over surfaces already rusted without removing all the rust! Simply wirebrush and use sharp scrapers to remove rust scale and loose particles . . . sandblasting and chemical pre-cleaning are not usually required. Easy to apply by brush, dip, or spray . . . dries to a firm, pliable coating. Cut your maintenance costs, save metal — with RUST-OLEUM! Prompt delivery from Industrial Distributor stocks in principal cities.

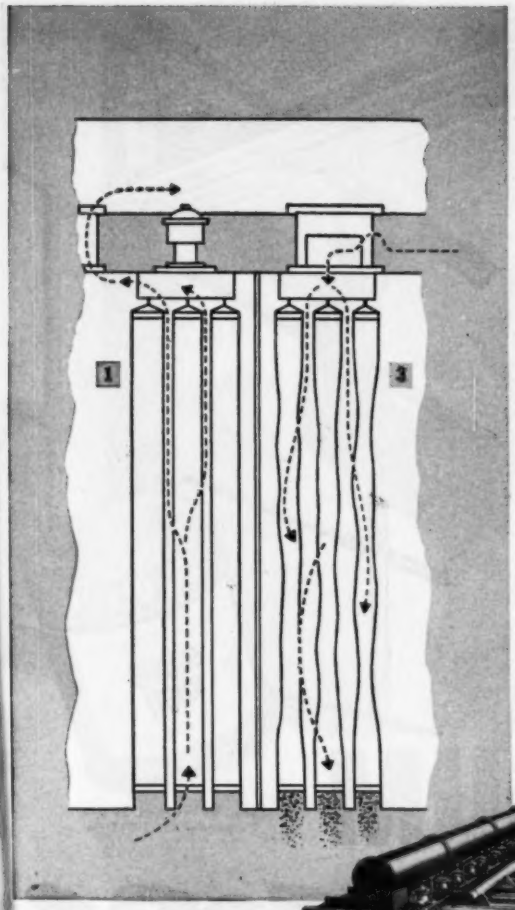
RUST-OLEUM CORPORATION
2471 Oakton Street, Evanston, Illinois

STOPS RUST!

FREE SURVEY: A RUST-OLEUM specialist will gladly survey your rust problems. He'll make specific tests and recommendations. No cost or obligation. See Sweets for complete catalog and nearest RUST-OLEUM distributor, or write for literature on your company letterhead.

CLIP THIS TO YOUR LETTERHEAD
MAIL TO: RUST-OLEUM CORPORATION
2471 Oakton Street • Evanston, Illinois

- ☐ Have a Qualified Representative Call
- ☐ Full Details on Free Survey
- ☐ Complete Literature
- ☐ Nearest RUST-OLEUM Source



How Norblo gives you 24-hour-a-day dust collection at full rated capacity

Fast double-action bag cleaning assures full efficiency and constant suction drop across the arrester

No matter what the task in large scale continuous operation, Norblo equipment stands the gaff — with low maintenance and economical over-all cost. Norblo Automatic Bag Type Dust Collectors have been completely reliable in all types of installations for over 25 years, proving the soundness of the operating principles described below:

1 Basic unit compartment houses 78 cylindrical bags — fully distended by upward inside air flow.

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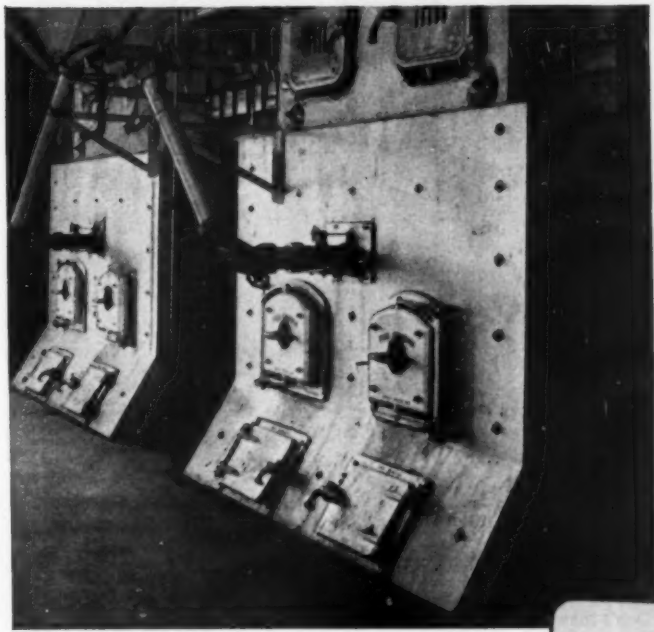

says Mr. William C. Musch, Chief Engineer, Allen Memorial Hospital, Waterloo, Iowa.

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LOW STACK DUST EMISSION AT WEST CENTRAL HEATING PLANT

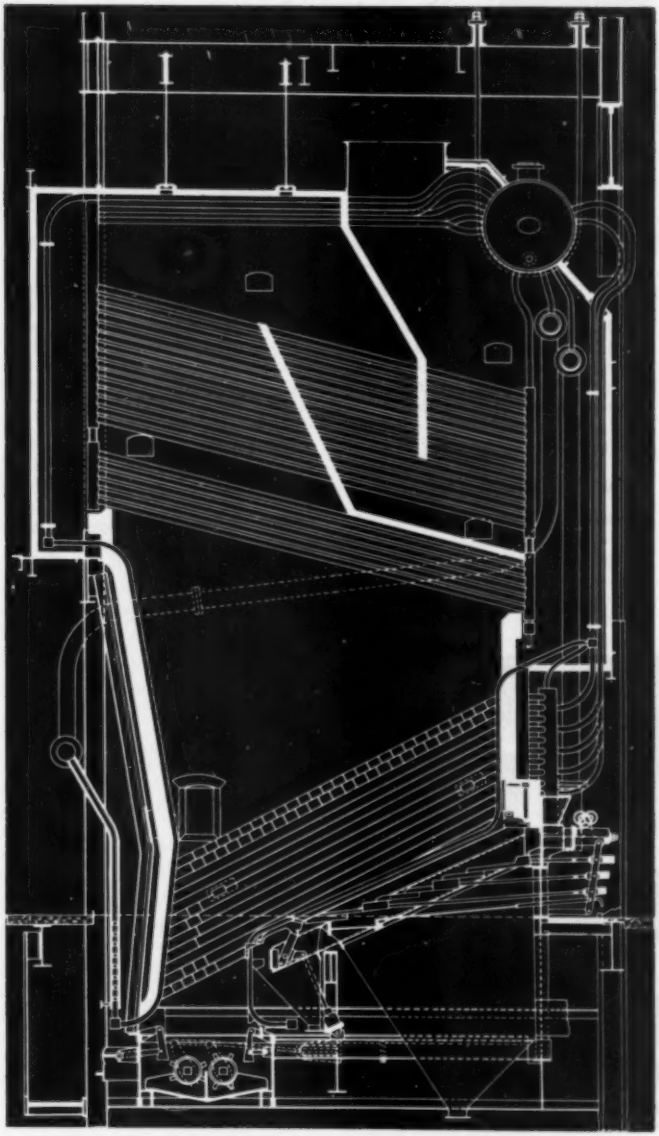


Fig. 1—Three underfeed stoker fired boilers, each designed for a continuous output of 150,000 lb per hr at 250 psig pressure, are installed at the plant

Precipitator tests conducted at this plant show dust loading in the stack gases is considerably less than the accepted standard specified in the ASME Code

WILLIAM S. MAJOR
Project Engineer, Power Dept.
Dravo Corp.

STACK DUST EMISSION at the West Central Heating Plant is well below the accepted dust loading for gases specified in the ASME Code. This performance is due to conservative design of the boiler, stoker, furnace and dust collector through which the gases pass before discharging to the atmosphere. This article reveals results of tests that were conducted to determine dust loadings in stack gases from the newest steam generator.

Boiler Design

Fig. 1 shows a sectional side elevation of one of three identical cross drum, straight tube steam generators that serve a group of Government buildings in Washington. It is designed for a normal saturated steam load of 150,000 lb per hr at 250 psig and can produce 240,000 lb per hr for two hour peaks. Firing equipment consists of a multiple retort underfeed stoker with crusher rolls for continuous ash discharge. Both coal feeding rams and ash discharge crusher rolls are driven hydraulically by a pumping unit mounted beside the boiler as shown in Fig 2. The stoker tuyeres receive protection from tubes that are extended to provide partial water cooling for the front furnace wall. Sides of the furnace also are partially water cooled by tubes located substantially parallel to the slope of the stoker grate.

After gases leave the boiler, they pass through an electrical precipitator equipped with a continuous or sequential rapping device. As a result, the collecting electrodes are cleaned at a continuous rate, and there is negligible

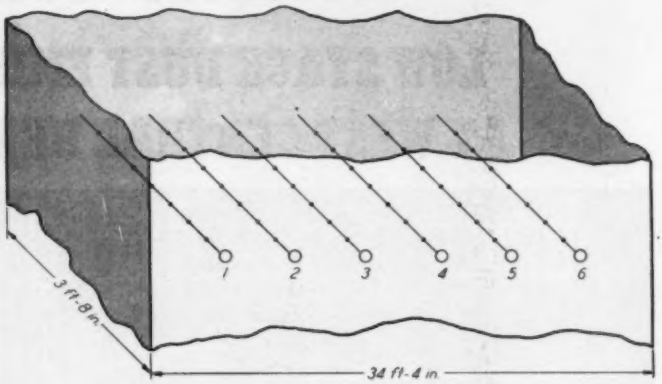
re-entrainment of the collected dust in the cleaned gas stream. This arrangement also eliminates any nuisance from intermittent puffs or clouding that accompanied the earlier practices of periodic rapping of electrodes. The unit is designed for removal of not less than 95 per cent of the total cinders and dust entering the precipitator for the entire range of gas flow from zero to 170,000 cfm at 600 F.

Method of Testing

Testing of the precipitator was in accordance with the ASME standard method for gas sampling. Briefly, this method consists of determining dust concentration of the gas entering and leaving the precipitator by drawing gas through a nozzle into a thimble contained in a holder at the same rate that gas flows in the duct. The filtering media is an alundum thimble which is dried at 105 C, cooled and weighed prior to and after use. Velocity and volume of the gas is determined by means of a pitot tube and an Ellison draft gage. Once velocity is established at the sampling point, meter rates are determined and the apparatus is ready for operation.

Basically, the apparatus consists of a holder with nozzle attached containing the weighed thimble. This is connected by tubing to a gas flow meter, for volume measurements, which includes a thermometer to indicate gas temperature and a mercury gage to measure pressure. An aspirator regulates the suction through the apparatus in order to obtain desired gas velocities. Sampling is done simultaneously at both inlet and outlet and must cover a complete traverse of the flue area. Fig. 3 shows the location of stations in the duct to the precipitator for dust sampling and velocity traverses. A similar set of sampling points was established in the duct that conveys gases leaving the precipitator. From the differential between dust weights at the inlet and outlet of the precipitator, efficiency can be determined.

FIG. 3—LOCATION OF STATIONS IN DUCT TO PRECIPITATOR FOR DUST SAMPLING AND VELOCITY TRAVERSES



Initial Precipitator Tests

Results of three tests conducted during the early part of 1951 showed an average dust collection efficiency of 90.8 per cent. This performance accompanied an average flow of 122,000 cfm at 593 F, equivalent to 72 per cent of rated precipitator capacity. Since the efficiency was over 4 per cent below design performance, an analysis was made to determine if any abnormal conditions existed. This included a study of such factors as dust size, combustible content, gas flow pattern and dust concentration at the different sampling stations.

Table 1 lists size consist and combustible content of the dust entering and leaving the precipitator. These figures are quite representative and were in no way interpreted as contributing to the lower collection efficiency obtained during the initial tests.

Fig. 4 shows the variation of dust concentration and precipitator efficiency as determined from data collected at the six stations entering and leaving the precipitator. It will be noted that dust concentrations are much higher at the two outside stations (No. 1 and No. 6) than at the four other stations. Furthermore, the highest efficiencies are at the outer areas of the precipitator, ranging from a low of about 82 per cent in the center to over 98 per cent at station No. 6. Studies of gas velocities also revealed a considerable variation with velocity at the four inner stations averaging 45 per cent higher than the values obtained at the two outside locations.

Since there is every reason to believe flow pattern at the inlet carries on through the precipitator, it seemed likely that differences in initial velocity and dust concentration were responsible for the wide variation in efficiency. From this deduction, it was believed that more thorough mixing of the gases prior to entering the precipitator and more uniform velocity at the inlet would result in higher average collection efficiencies. In order to real-

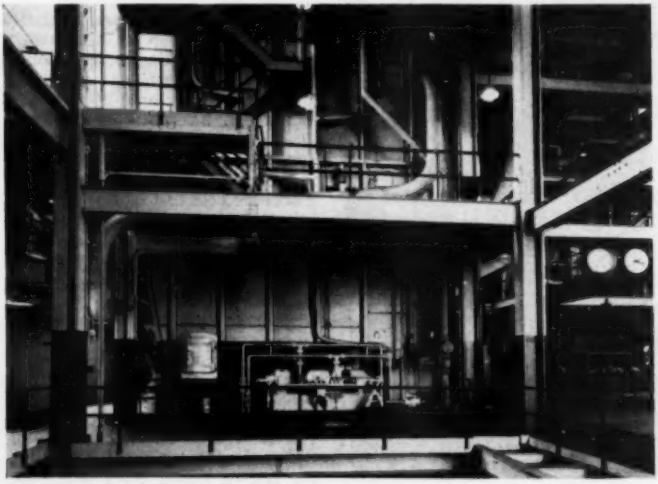


Fig. 2—Hydraulic pump units, mounted beside the boilers on the operating floor, are used to drive both the coal feeding rams and ash crusher rolls

FIG.4—VARIATION IN DUST CONCENTRATION AND EFFICIENCY OF PRECIPITATOR
Average of tests 1, 2 and 3

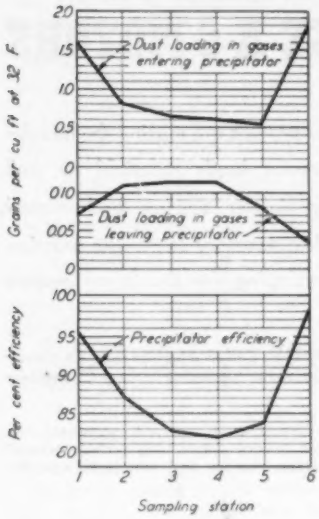
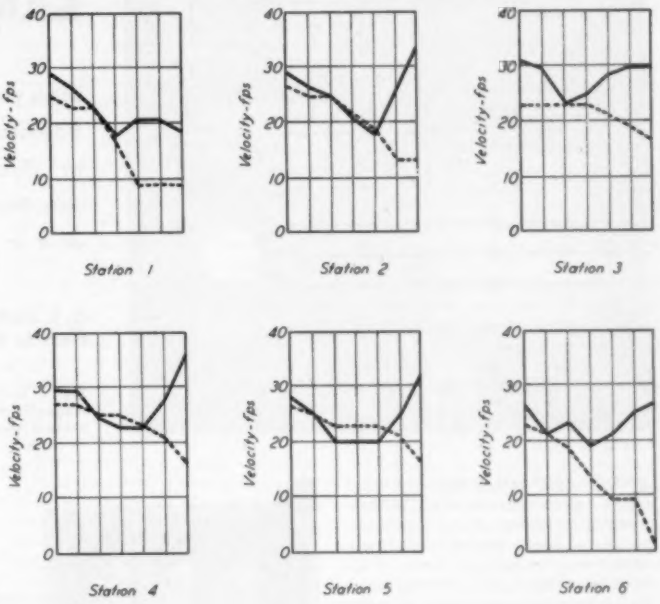

Grains per cu ft at 32 F
Dust loading in gases entering precipitator
Dust loading in gases leaving precipitator
Per cent efficiency
Precipitator efficiency
Sampling station

FIG. 5—TYPICAL VELOCITY TRAVERSES ACROSS INLET DUCT TO PRECIPITATOR

------ Prior to installation of plate to equalize velocity and mixing device for more uniform dust concentration

——— After installation of plate and mixing device



ize these objectives, the precipitator manufacturer installed: (a) a horizontal perforated plate to equalize inlet velocities, and (b) a mixing device ahead of the plate to obtain more uniform dust concentration.

Final Precipitator Tests

Table 2 summarizes the results of two tests after installation of the additional equipment. Test efficiency in each case not only exceeds the guaranteed performance of 95 per cent collection efficiency, but also results in stack dust emission substantially below the most stringent ordinance.

Velocity traverse readings at the six stations across the inlet duct as recorded during both the initial and final tests are indicated in Fig. 5. Broken lines show performance at 72 per cent of precipitator rating prior to the installation of plates for equalizing velocity, while solid lines cover data at approximately 85 per cent of precipitator rating after the modifications. From a study of performance at stations 2, 3, 4 and 5, it will be noted that while the velocity pattern changed, there was still considerable velocity variation. At the outer stations, however, two pronounced changes were apparent after the velocity equalizing device was installed: (a) there was much less variation in the velocity across the duct, and (b) regions with very low velocity were eliminated. Quite likely, the more uniform velocity pattern at the outer stations was the main reason for improved precipitator performance during the final tests.

The low dust content of the stack gases as compared to the ASME Code is appreciated more readily when test data is expressed as pounds of dust per 1000 lb of gas adjusted to 12 per cent CO_2. Tests 4 and 5 showed an average result of about 0.07 lb of dust per 1000 lb of gas. This result is less than one tenth of the ASME Code value of 0.85 lb of dust per 1000 lb of gas discharged to the atmosphere.

TABLE 1 — DUST ANALYSIS ENTERING AND LEAVING PRECIPITATOR

Test No.		Mesh	Microns	1	2	3
					Per cent	
Inlet	On	50	297	54.5	34.2	56.3
	On	100	149	72.3	54.3	77.8
	On	200	74	89.8	72.9	89.1
	On	325	44	95.8	85.3	93.9
	Through	325	44	4.2	14.7	6.1
		Combustible		29.4	28.2	58.6
Outlet	On	50	297	10.8	17.2	21.3
	On	100	149	32.7	36.8	43.9
	On	200	74	74.5	58.6	66.1
	On	325	44	91.4	74.6	81.9
	Through	325	44	8.6	25.4	18.1
		Combustible		21.2	22.6	47.4

TABLE 2 — FINAL PRECIPITATOR TESTS

Test No.	4	5
Gas flow in cfm	163,000	127,000
Gas temperature in deg F	570	570
Grains per cu ft at 32 deg F		
Entering precipitator	0.919	1.291
Leaving precipitator	0.0276	0.0539
Precipitator efficiency in per cent	97.0	95.9

Acknowledgments are extended to the Research Corporation of New York whose engineers supervised the testing and calculated test results.

CONTROLS FOR LARGE A-C MOTORS

Better power systems are making the heavier individual motor loads practical as well as allowing simpler starting and control units. Here is a summary of modern practice as it is developing for the larger motors

G. L. OSCARSON, Chief Application Engineer
Electric Machinery Manufacturing Company

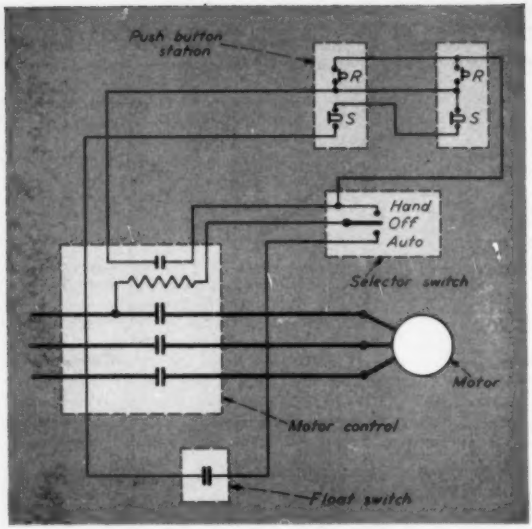


Fig. 1 (left)—Circuit of an unfused, across-the-line magnetic starter is very simple, may include several manual push-button stations and automatic controls

SIZE AND NUMBERS of large a-c motors have been and are consistently increasing. Concurrently, capacities of power systems to carry sustained and momentary heavy loads have been rising, and the trend is reflected in voltage and design of motor starting and running controls. Across-the-line starting is increasingly practical and common, and takes advantage of the higher torques available for quickly starting heavy loads. At the same time, auxiliary and protective controls are being modified to produce consistently better results.

GENERAL

The function of motor control is to:

1. Properly start the motor, with due regard for existing electrical and mechanical conditions.

2. Protect equipment and personnel, during starting and operation, against abnormal conditions.

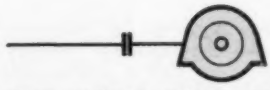
Motor controls may be manual or magnetic, depending on whether the necessary switching operations are performed by hand or electrically.

Magnetic controls may, in turn, be manual or automatic, depending on whether the energizing circuit is actuated by hand or by some load condition, such as water level.

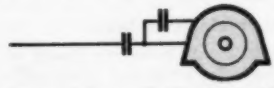
Where automatic control is involved, as when motor starting is controlled by load condition, a three position transfer switch having *HAND-OFF-AUTOMATIC* positions, is common.

On *HAND* position the motor starter is controlled by a *START-STOP* pushbutton station. As many stations as desired may be placed at convenient

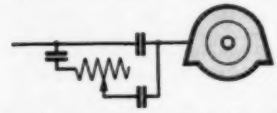
Fig. 2—Interrupting capacities of control contactors are adequate for starting currents but not for faults. Current limiting fuses, as in this synchronous motor control, or breakers are needed in the power supply line



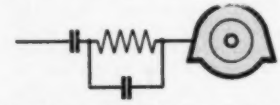
Full voltage starting is used when possible because of high torque, simplicity, low cost



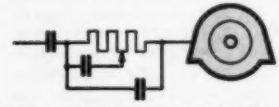
Part winding system uses no autotransformer or impedance. It may have two or more steps



Autotransformer reduces starting voltage. Open-transition surges often objectionable



Reactor starting is simple but provides low starting torque in proportion to line kva



Resistance starting is occasionally used on the smaller motors on low voltage lines

Fig. 3—Full voltage starting is used except on limited supply or to obtain torque steps for synchronous and squirrel cage motors

locations. The circuit for two such stations is shown in Fig. 1. The control circuit is the conventional three wire arrangement with *START* buttons in parallel and *STOP* buttons in series. This gives undervoltage protection in that a *START* button must be pushed to restart the motor if the contactor drops out due to low voltage, and provides maximum protection to equipment and to operators.

In the *OFF* position, the motor cannot be started, but for *AUTOMATIC*, the contactor will be closed whenever the load actuated device (for instance a float switch) is in the compelling position. Such a control then has low voltage release. The motor will restart immediately on restoration of voltage if the controlling device is in the position calling for operaton of the motor. In effect, it corresponds to a two wire manual control circuit.

PRIMARY CONTROLS

Protection

Large a-c motors may be squirrel cage, wound rotor, or synchronous. They all have one thing in common. The stator winding must be connected, through a primary control, to the incoming alternating current source.

Wound rotor motors are always connected directly across the line, the current input being controlled by the amount of secondary resistance.

Electrical and mechanical conditions permitting, squirrel cage and synchronous motors are also preferably started on full voltage. In some cases, reduction of starting torque, or of starting current, will call for some reduced kva method of starting.

Starting kva, torque values, and methods of obtaining reductions of these values will be discussed later.

Primary controls are always provided with certain types of motor protection:

Overcurrent protection is always used. In three phase, three wire systems, two overcurrent relays are provided. Three phase, four wire systems require protection in all three line leads. On low voltage installations, the relays are usually of the series type, while high voltage controls have the relays connected to current transformer secondaries.

Thermal type relays are preferable for this duty. They automatically provide some delay to accommodate the higher current during starting. Also, cumulative heating caused by repeated starts will trip the motor from the line before excessive heating results.

On magnetic primary controls, tripping action usually merely breaks the circuit of the holding coil. On certain types using mechanically latched-in contactors, shunt trip is used. This requires a dependable source of supply such as a battery. The contactor is opened by energizing a trip circuit.

Undervoltage protection, requiring energizing of the control circuit before restarting, is used on all controls actuated by hand. In some cases, time delay undervoltage releases are used, specifically where it is desired to have a motor ride through voltage dips of short duration.

Phase reversal relays are occasionally used, as where driven equipment would be damaged if rotated backwards. Relays protecting against single phase operation are sometimes provided.

On large, important motors, differential protection is frequently applied to shut down the motor even in case of a minor fault in the stator winding.

A normal running contactor is not expected to interrupt more than ten times the full load current of the motor for which it is designed. A breaker, or fuses, must be provided ahead of the control to take care of faults.

However, where several large important motors are operating in a group it is undesirable to stop all of them because of a fault in one motor. This has led to the use of current limiting, high interrupting capacity fuses in conjunction with the contactor. Sizes available will interrupt faults up to 150,000 kva at 2300 v, or 250,000 kva at 4000 v. A typical control incorporating such fuses is shown in Fig. 2. Care must be taken that the starting current and accelerating time are such that they do not damage the fuse, also that the contactor rating and tripping time of its overload relays are properly coordinated with the fuse.

Torques and KVA

Wound rotor motors are used where high torques and low kva during starting, or controllable torque during operation are required. The motor has a phase wound secondary brought out to slip rings connected to external resistors. The primary is connected directly across the line, and is interlocked so it cannot be closed unless the secondary resistance is all in for minimum starting kva.

Fig. 4 illustrates torque and kva of a wound rotor motor used with a centrifugal compressor. Intersections of curves R-1, R-4, R-7, R-10, and R-11 with the load curve are balanced operating points. Intermediate steps shown are for acceleration only.

Synchronous and Squirrel Cage. Locked rotor, full voltage torques of various synchronous and squirrel cage motors may range from 40 to 225 per cent of full load values. Full voltage starting kva may range from 250 to 700 per cent of full load kva.

In some cases, as on flour mill line shafts, a starting torque of 160 per cent may be required. However, if it is applied all at once, serious mechanical damage may result. In other cases, the matter of torque reduction is not urgent but it is necessary to restrict starting

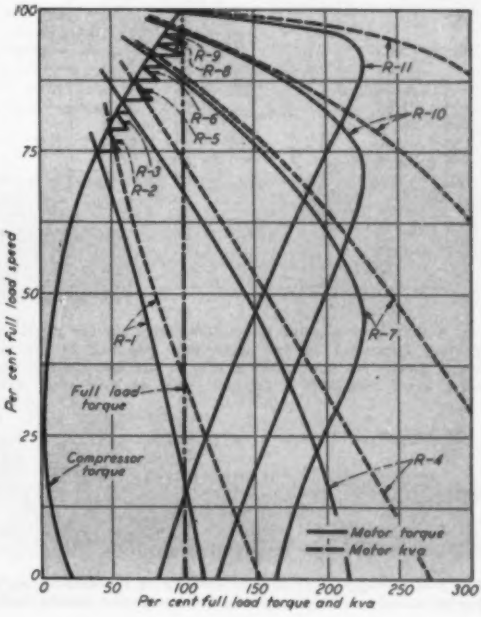


Fig. 4—The speed-torque curves of a wound-rotor motor vary according to secondary resistance. The operating speed is at intersection of the motor curve and the load curve, shown here for a centrifugal compressor. Full motor curves are balanced operating points. The intermediate steps are for acceleration

kva on account of service limitations.

Reduced starting torque and kva may be obtained in various ways. Fig. 3 illustrates various methods for synchronous or squirrel cage motors.

Different starting methods will have different ratios of torque to kva, and their selection will be based on various requirements. Table 1 illustrates torque and kva ratios for starting.

Conventional reduced voltage starting has a high ratio of torque to kva, but has open transition from reduced to full voltage which may result in undesirable electrical and mechanical shock. By the addition of a switching step, closed transition is possible. Reactor and resistor starting provide closed transition and positive torque during the acceleration period, but have a low ratio of torque to kva.

The part winding method combines high torque to kva ratio and closed transition. It is particularly applicable to large size, low speed motors. Three step, part winding starting is frequently used on flour mill line shafts where high total starting torque may be required, but it is desirable to apply it in definite increments when both windings are needed to start the load to prevent mechanical shock.

Fig. 5 shows a simplified line diagram and oscillogram of two step, part winding control.

In any case involving starting of squirrel cage or synchronous motors on reduced kva, it is important that sufficient starting to overcome static friction and accelerating torque be present. Torque and kva values usually bear a fairly constant relationship to each other. If a certain torque is required, the kva value is practically established. There is no advantage to designing a motor with high starting torque and kva and then starting it on reduced voltage. It should be designed for full voltage starting.

TABLE 1—STARTING CONDITIONS IN PER CENT OF FULL VOLTAGE VALUES

Starting method	Motor voltage	Line kva	Motor torque
Full voltage	100	100	100
Part winding	..	60	60
Reduced voltage	78	60	60
Resistor or reactor	60	60	36

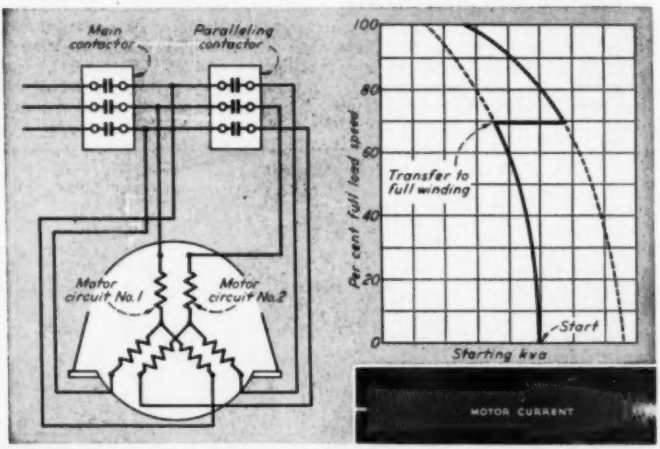


Fig. 5—The part winding system illustrates current relationships during starting. Current is limited by first energizing only half of the motor through Circuit No. 1. Circuit No. 2, connected after a time delay, brings motor to speed or provides extra torque if it fails to start on first step. Avoids transition shock

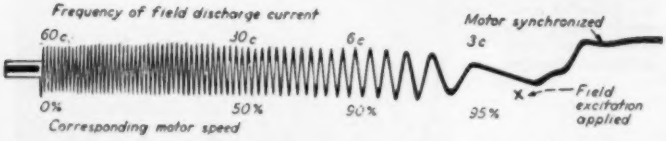


Fig. 6—Oscillograph of current induced in synchronous motor field during starting shows how a frequency sensitive relay can automatically connect excitation

Braking

It is frequently desirable to provide emergency braking on a-c motors. Squirrel cage and wound rotor types are usually braked by disconnecting them from the line and reconnecting them with one phase reversed. The motor then plugs to a stop and a zero speed switch disconnects it.

Synchronous motors may also be plugged to a stop; or they may be dynamically braked by disconnecting the stator from the line, and reconnecting it to a resistive load, leaving full excitation on the field winding.

SYNCHRONOUS CONTROL

Synchronous motors are unique in that they are locked into step with the rotating stator field for operation by application of d-c excitation to the field winding. The motor must first accelerate on its amortisseur winding to near synchronous (95 to 97 per cent) speed. Excitation is then applied and the motor pulls into step.

During acceleration, a single phase alternating current is induced in the field, Fig. 6, with the frequency varying from 60 c at zero speed down to 3 c at 95 per cent speed (on 60 c service). A discharge resistor, selected to provide desired torque and voltage characteristics, is connected in series with the field winding during starting.

The induced field current is an accurate measure of the speed of the rotor and of its position in the rotating magnetic field of the stator. Most synchronous motor controls therefore use a relay responsive to the polarity and frequency of the induced field current to close the field contactor and apply the excitation. This automatically removes the field discharge resistor from the circuit.

The amortisseur winding is the most critical part of a synchronous motor and a relay is provided which automatically shuts down the motor during starting unless synchronization is effected within a suitable time. This relay also becomes effective if the motor drops out of step.

One or more of three conditions will cause a synchronous motor to drop out of step. These are (a) excessive drop in line voltage, (b) excessive drop in excitation current, and (c) excessive load. A relay is provided which recognizes the fact that the motor is out of step. This relay may either shut the motor down, or it may open the field contactor to put the motor back in starting condition and permit it to pull into step if electrical and mechanical conditions permit.

INSULATION .....
TYPES AND PROPER APPLICATION

Here is an article that embraces all phases of insulation, from the types available to industry, to the types that are applicable for hot and cold pipes and air conditioning ducts. Each type of insulation is reviewed, and installation practices are discussed

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ASBESTOS is frequently used for high temperature insulation, from 600 to 1200 F. One type consists of long fiber bonded with a water and heat resistant inorganic binder. Pipe insulation for temperatures up to 650 F is provided with a jacket of canvas, or other material, and weighs only 12 lb per cu ft. For the higher operating temperatures, up to 1200 F, the pipe insulation and block insulation weighs 14 lb per cu ft. All of these have high insulating efficiency and good physical stability and are unaffected by steam, acids and fumes ordinarily encountered in industrial plants. They are not affected by moisture, are not brittle, and do not powder or shatter under severe vibration and impact, which, in some instances, are very important properties.

Wide ranges of thicknesses are available so that the insulation may be applied in one layer, which, of course, saves labor and expense. For piping it comes in half rounds and cylinders and, if so ordered, in segments.

Nested lines of pipes are insulated as a whole by using half rounds on the outside pipes and filling in with block insulation. Traced lines can be covered as one by a single over-sized section of pipe insulation. Flanges, valves and fittings with irregular surfaces can be handled with sections of pipe insulation with a minimum of time and effort. Bends are usually covered with mitered sections, and the surface is finished in a smooth curve with asbestos cement.

Flexible Insulation

Flexible insulation is also made for small pipe and tubing for temperatures up to 500 F in three forms, namely, for lacing in place, for wrapping, and for slipping on. The first of these is made of woven asbestos fiber with a covering of neoprene-coated asbestos cloth. It is provided with sealing laps, which make an effective seal.

The second is made up of a woven asbestos tubular jacket filled with asbestos rovings and is wrapped spirally around the pipe or tube. It is used largely on low pressure or temporary lines and bent piping or tubing.

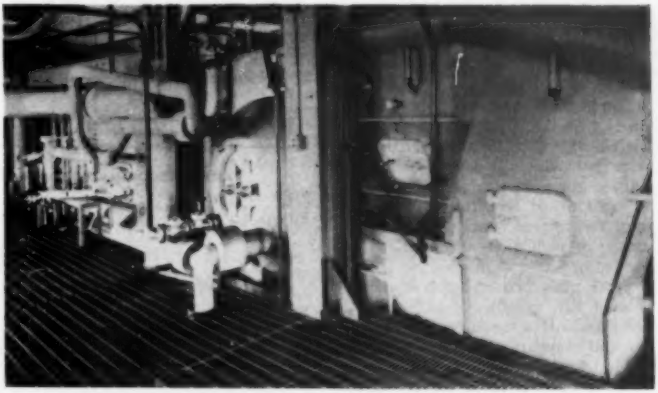
Third type of flexible insulation, for slipping on a pipe, is made of an inner tubing of braided asbestos covered with a very light weight fibrous glass insulation and an outer jacket of braided asbestos tubing. This outer jacket may be untreated, coated with synthetic rubber, or have a hermetically sealed vapor barrier and coated jacket. This insulation is specially designed for bent tubing and small tubes.

Tailored Applications

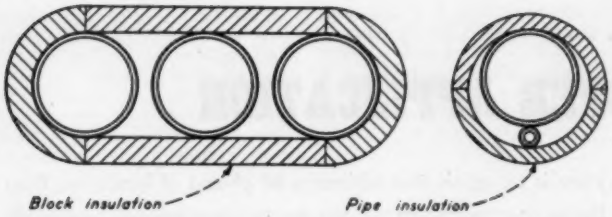
Of course, many items of industrial equipment call for "tailored to fit" insulation. For instance a removable stop valve cover may be made of the bonded asbestos fibers and asbestos jacket. In many cases metal mesh blankets, consisting of light weight resilient fibrous glass faced on one or both sides with metal facing, are used to insulate tanks, boilers, large ducts, and breechings. For temperatures up to 1000 F white glass wool blankets are employed, while for temperatures up to 500 F a similar glass fiber is lightly bonded with a resinous binder. This type of insulation with the metal mesh on only one side is particularly useful when the blanket is placed around irregular surfaces or curves of small radius.

Glass fiber is another type of widely used thermal insulating material. It comes in several different forms for different applications and has very low thermal conductivity. Glass fiber is incombustible and will withstand temperatures up to 1000 F, although certain types pre-formed with thermosetting binders are limited to 600 F. It is very durable and resistant to corrosion when in contact with steel, and unbonded types will not settle on account of vibration. It is also very light in weight.

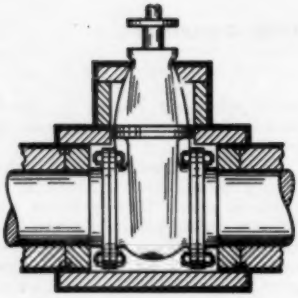
Insulating wool is a soft, fleecy material of glass fibers, which are slightly lubricated. They are fabricated in batts, rolls, bulk, and shredded. The rolls and batts are used for insulating prefabricated and pre-assembled equipment with fully enclosed insulation such as industrial and bakery ovens.



Insulation, whether it is applied to hot or cold surfaces, can enhance the appearance of the equipment it covers plus preventing heat loss or heat gain



Insulation for pipes is made up of special sections, such as these above. When two or more pipes are covered a block is placed between the circular sections



Valves are insulated with sections of half round. Joints are then cemented

The shredded and bulk forms are used to fill expansion joints and to pack small and irregular spaces.

Another kind of glass fiber insulation is accurately pre-formed for standard sizes of tubing up to 3 in. in diam and iron pipe up to 33 in. in diam. It is suitable for temperatures up to 600 F, and both longitudinal and end joints fit accurately so that pointing is unnecessary. Lacquered steel or aluminum bands are used to hold sections up to 12 in. in diam in place, or joint seal strips on exterior finishes may be used and spaced to give proper support. When the pipes are over 12 in. in diam 16 gage soft annealed wire should be used, and if a double layer is applied the first layer should not have a jacket. The second layer is placed with the joints staggered with respect to the first layer. Canvas is utilized for indoor finishes. Insulation in outdoor or wet indoor locations must be covered with a roofing felt jacket, or with a sheet metal jacket banded or wired in place.

Fiber glass blanket type insulation is used for spirally welded, riveted, non-standard, irregularly shaped piping and standard pipé from 3 to 42 in. in diam for temperatures up to 1000 F. The insulation consists of an insulating wool with a wire mesh facing with metal selvages at the ends so that it may readily be bound tightly around the pipe. The blankets are wrapped around the pipe and held in place by lacing or tying the selvage with 16 gage soft galvanized wire.

On bends the selvages are laced on the outside radius, and for indoor locations the finish is of 2-ply rosin paper under canvas. For outdoor locations roofing felt is wired or banded in place.

Very fine glass fibers made in rolls of different thicknesses and widths can be wrapped around nested pipes operating at the same temperature. It is also applicable for steam traced lines irregular surfaces and valves, fittings, and connections that are difficult to insulate. This insulation is tied or taped, then given a finish depending on the exposure. For indoor service, red rosin paper is tied on and covered with canvas. For outdoors 45 lb roll roofing is applied over the insulation and held with 16 gage soft galvanized wire on 6 to 8 in. centers.

This type of insulation is cut in sections to length and wrapped around the perimeter to the required thickness plus a 3 in. overlap. It is designed for operating temperatures of 600 F.

Glass fiber metal mesh blankets, blocks, and insulating cement are frequently employed to cover large sections of industrial heating units, such as ovens, boilers, process equipment, and tanks.

These metal blankets are especially designed to insulate equipment with surface irregularities and projections, including rivets, seams, and laps. It is made in two types, one for operating temperatures up to 600 F, the other for 1000 F. The blankets are applied with the lath side exposed and laced along the joints with 16 gage galvanized wire. The lacing is then fastened to anchors consisting of hooks, bolts, or steel angles welded to the surface of the equipment. The final fastening is by horizontal steel bands or wire.

Finishes

Several final finishes are available for different service conditions. First, however, a ½ in. coating of cement is trowelled over the metal mesh and allowed to dry, after which a second coating ¼ in. thick is applied. For protected areas the final finish consists of 6 or 8 oz canvas sewed or pasted in place. Where exposed to the weather 1 in. galvanized wire netting is laced in place with 16 gage galvanized wire. This is followed with smoothly trowelled ¼ in. wet thickness of fiber glass mastic. When protection against severe mechanical abuse is necessary the insulating cement is covered with a sheet metal jacket.

Glass fiber block insulation is suitable for operating temperatures up to 600 F. The common method of application consists of placing the blocks with the joints staggered and fastening them with horizontal steel bands or wire. Corners are protected with metal corner beading. For equipment such as stationary tanks and ovens over 15 ft high, bolts or angles welded to the surface, steel stud welded rods, or wires provide good anchorage. Where the insulation is in cavity walls or panels the blocks are laid up to fill the area with end joints staggered.

When a rough finish is sufficient the voids and openings between blocks are filled with insulating cement. The standard finish consists of stretching tightly 1 in. galvanized wire netting

TABLE I—RECOMMENDED MINIMUM THICKNESS MINERAL WOOL BLANKET**

Temperature, F	Pipes 2 to 4 in.	Pipes 4 to 6 in.	Pipes 6 in. and up
150 to 250	1	1	1
250 to 350	1	1	1
350 to 450	1	1	1½
450 to 550	1	1½	1½
550 to 650	1½	1½	2
650 to 750	1½	2	2
750 to 900	2	2	2½
900 to 1050	3	2½	3
1050 to 1200	2½	3½	4

**For indoor locations, when outdoor add ½ in.

over the blocks and lacing it securely with 16 gage wire. A ½ in. coat of insulating cement is trowelled over the base. Final finishes are the same as for metal mesh blankets.

Glass fiber insulating cement has some other imporant uses. For example pipe elbows, valves, flanges, and irregular sections can be insulated with trowelled cement of a thickness equal to the insulation applied to the rest of the unit. Employed in this manner the cement is applicable for temperatures up to 1500 F. For clean steel surfaces, applications are applied in ¾ in. thick coats. Each coat must be dried before the next is applied. One inch galvanized wire netting is used for reinforcement between every second coat.

When the cement is applied to brick, 1½ in. masonry nails are driven into the mortar joints on 8 to 12 in. centers with ¾ in. of the head exposed. The brick must be thoroughly wet, and the first coat is applied nearly flush with the nail heads. One inch wire netting is stretched tightly over the cement, after it has dried, and secured to the nails. Other layers ½ to ¾ in. thick are then applied as needed with every second coat reinforced with the wire netting.

High Temperatures

For operating temperatures up to 600 F 85 per cent magnesia insulation is very widely used. It is made of magnesium carbonate and asbestos fibers. As a pipe covering it comes in molded half sections with the canvas covering forming a hinge and lap and is held in place with metal bands.

Another type of pipe covering, similarly constructed, suitable for temperatures up to 700 F, is made of crimped layers of asbestos paper, with approximately 33 layers per in.

A third insulating material made of diatomaceous earth bonded together with asbestos fiber is good for temperatures up to 1900 F. The high temperature covering is applied next to the hot surface, thick enough to reduce the temperature at the outer surface to 600 F. The outer layer consists of 85 per cent magnesia insulation. Both of these come in half or segmental sections, for the larger sizes, with canvas covering, which hinges the sections and provides an overlap. These three last mentioned materials are also available in block form.

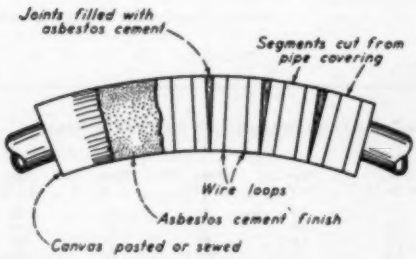
Hot pipes carrying steam or process liquids can be covered with glass fiber and covered with asbestos canvas. Final finish is asbestos paint or cement

Mineral wool blankets suitable for operating temperatures of 1200 F are also available. They are made in flat sheets with several different types of metal fabrics between layers. Standard manufactured sizes are 2 x 4 ft and 2 x 8 ft, and range in thickness from 1 to 8 in. These blankets are flexible and can be applied to curved and irregular surfaces with economy and speed.

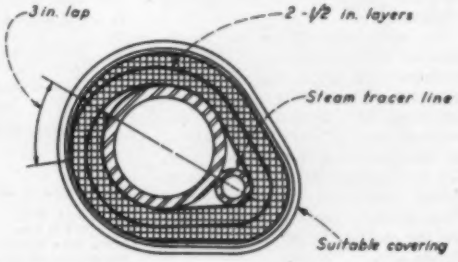
Parallel or nested piping is best insulated with a half section of pipe covering of suitable size fitted to the outer half of each pipe. Block insulation can then be employed to fill in the space between the pipes. The insulation is held in place with wire and covered with rosin sized paper and a sewed canvas jacket.

Pipe bends are covered by mitered segments of pipe insulation cut to the contour of the bend. Each segment is wired in place, and the joints are pointed with asbestos cement. A coating of asbestos cement is then applied to give a smooth surface. A weatherproofing can be added if necessary.

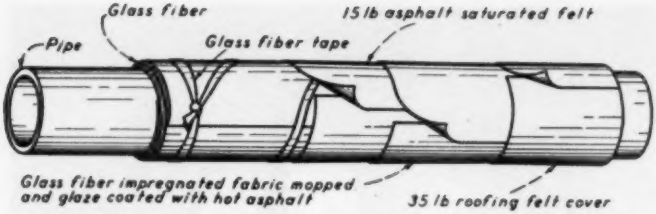
Application of block material is well illustrated in insulating a boiler drum. The blocks are carefully fitted and placed against the steel surface and held with bands or cables. Fibrous adhesive may be used to hold the blocks until the bands or cables are applied. For very high temperatures, up to 1900 F, there is an inner layer of diatomaceous earth and asbestos fiber blocks and an outer layer of 85



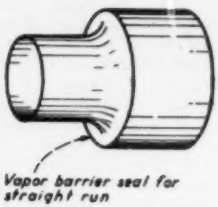
Segments cut from straight cork pipe insulation are tied around the bend. Joints are filled with asbestos cement



Blanket type insulation is wrapped around the pipe or pipes to thickness desired. It is wired into place and covered


Glass fiber
15 lb asphalt saturated felt
Pipe
Glass fiber tape
Glass fiber impregnated fabric mopped and glaze coated with hot asphalt
35 lb roofing felt cover

Pipes conveying cold liquids can be wrapped with blanket insulation, tied down with tape, and covered with asphalt felt. Final cover is canvas or roofing felt



Vapor barriers are secured to the pipe at end of every 25 ft of straight run

per cent magnesia blocks. In either case when the blocks are all wired in place a netting of hexagonal mesh is stretched tightly over the surface. Two coats of asbestos cement, totalling about ½ in. thick, are applied over the netting. The second coat is generally trowelled to give a smooth finish.

Another type of insulating material, adaptable for very low and medium high temperatures up to 212 F, consists of very small glass cells, which are sealed and filled with dead air. This insulation is solid, rigid, and light in weight and is a true glass. It is non-combustible, has unusually high resistance to moisture and vapors, acid fumes, and is not subject to decay. It can be worked easily with ordinary tools, and being friable may be pressed down on irregularities such as rivets and welds. Furthermore, no vapor seal is required.

Pipe Insulation

Pipe and fitting insulation of this material is available made to close tolerances from molded blocks. It may be had with a factory applied wrap consisting of a glass cloth membrane, which is cemented in place. A hinge for the two halves and a flap are provided that are cemented when installed. Also included is a utility finish for protection against impact and abrasion. For the larger pipe sizes curved segments or beveled lags can be supplied. Fitting insulation may be obtained from the factory or made on the job from blocks of standard pipe insulation.

For application to process equipment, all vessels under 12 ft diam are insulated with curved segments or beveled lags. Larger ones may be similarly insulated or with flat blocks. For temperatures over 100 F, joint sealer is not necessary, and the outdoor finish may be a spray coat ⅛ in. thick of asphalt cut-back. Corrosion-resistant wires, bands, or tapes are used to support the curved blocks, which may be applied dry.

Flat heads of vessels are insulated with flat blocks, cut to fit the inside of the extended side insulation. For curved heads, the segments may be cut in the factory or on the job and installed with beveled lags or square blocks. For ellipsoidal heads the side insulation may be extended as far as the crown of the head, and a flat circular disc of standard flat blocks inserted in the opening. If necessary, the extended side insulation should be provided with mechanical support.

Insulation of cold pipes and vessels involves some problems not encountered with relatively high temperatures. Furthermore, the several materials that make excellent coverings for cold applications are not suitable for hot conditions. In other words when insulating against cold, making a proper selection of material is just as important as when insulating hot vessels and pipes. The particular point that must be borne in mind when insulating cold equipment is that if moist air comes in contact with the cold surface there will be condensation or "sweating". Hence, all seams must be tightly sealed, and the insulation must be non-absorbant and moistureproof. If condensation should take place there will usually be dripping and possibly deterioration of the insulation.

Cork has a long record of successful performance in many kinds of low temperature operations. It contains great quantities (some 200,000,000 per cu in.) of hermetically sealed air cells, which give it a very low thermal conductivity. The structure is granular, and there is no capillarity so moisture is not absorbed.

One manufacturer makes cork pipe and fitting covering in three standard thicknesses for varying conditions. These thicknesses vary with the size of pipe and the following set of conditions: (A) — light duty such as ice water lines at 35 F or higher, (B) — standard duty as for lines carrying brine at 0 to 35 F, and (C) — heavy duty where the temperature is from –25 to 0 F. Where the temperature is lower, special designs are tailor-made for each application. Pipe and fitting coverings, molded to fit all standard sizes and shapes, have an asphalt covering inside and outside to protect them against moisture.

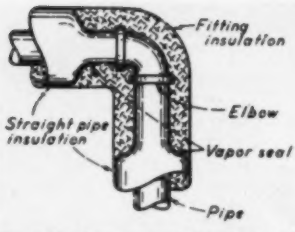
In 75 per cent of all pipe covering jobs, the pipes are first tested and the outside surface is cleaned before the proper thickness of insulation is applied. The joints are sealed with waterproof cement. Every effort should be made to butt the joints as closely as practicable. The insulation is held in place with copper clad steel wire on 6 in. centers. Where more than one thickness of insulation is used, all joints should come together as the broken joint method is not considered suitable for this method and material.

Fittings are insulated with coverings of a thickness corresponding with the straight run pipe insulation. The joints are carefully butted together and filled with waterproof cement. They are secured by at least 4 copper clad steel wires. Flanged and screwed fittings larger than 6 in. should have at least 6 wires.

Voids between the fitting and cover-

TABLE 2—RECOMMENDED INSULATION THICKNESS FOR COLD PIPE IN INCHES

Temperatures of pipe	Pipes Up to ¾	Pipes 1 - 2	Pipes 2½ - 3½	Pipes 4 - 6	Pipes 8 - 12
Ice water, to 35 F	1.5	1.5	1.5	2.0	2.0
Brine, 35 F to Zero	2.0	2.5	3.0	3.0	3.0
Heavy brine, Zero to -30 F	2.5	3.0	3.5	3.5	4.0
Refrigerants, -30 to -40 F	3.0	3.5	4.0	4.0	5.0



Vapor barriers are sealed to both ends of an elbow, which is sealed separately

ing are filled with a fine granulated cork or other space filler. If there are chipped edges they should be filled with seam filler. The outer surface of the insulation is then painted with a finish paint.

For locations where the atmosphere is heavily laden with steam or moisture, as in damp cellars, packing houses, or exposed to the weather, a roofing jacket is applied with overlapped joints and sealed with asphalt paint. The jacket is held in place with copper clad steel wire or staples.

Decorative Finishes

When the finish has to harmonize with the equipment or decorations the pipe covering is wrapped with rosin sized paper, and the fittings are given a coating of asbestos cement. A canvas jacket is then sewed over pipe and fittings and painted with lead and oil paint.

For low temperature piping a layer of mineral rubber cloth is applied with a 2 in. lap over the fittings. This is covered with a spiral wrapping of rubberized adhesive tape with a 1 in. lap. The finish may be either cork finish paint or lead and oil paint.

For tanks and other vessels, beveled cork lagging, plain or finished on either the outer or both sides with mineral rubber finish, is cut to fit the radius of the tank. The following thicknesses are recommended: for temperatures of 50 F and higher, 2 in.; between 35 and 50 F, 3 in.; between 20 and 35 F, 4 in.; between 5 and 20 F, 5 in.; and between -10 and 5 F, 6 in. For lower temperatures the insulation is specially designed for each job. Solid discs of corresponding thicknesses are provided for the ends, and they are inserted inside the extended side lagging.

Lagging is held in place by steel bands on about 8 in. centers. Voids between lagging and the vessel are filled with granulated cork. Seams are filled in such a manner as to leave a smooth surface for the finish, which may be a coat of paint, or a jacket of roofing or canvas that can be painted. Asbestos cement plaster is sometimes applied as a finish. Wire mesh is first placed around the cork insulation, and the cement applied in two coats to a total thickness of ½ in. All external edges have metal corner beads.

Weatherproofing

When the equipment is located outdoors it can be given a weatherproof mastic coating ⅛ in. thick. Where very severe conditions exist, either weather or danger of mechanical damage, a sheet metal jacket may be applied over the cork lagging.

Other manufacturers of cork insulation recommend substantially similar methods of application, although there are some variations due to the differences in the products. Proper application of the insulation is as important as quality of material, and when improperly installed the results will be unsatisfactory. This is strongly emphasized by all makers of insulation.

When temperatures from 50 to 100 F are involved hairfelt, wool felt, cork and other kinds of insulation may be installed. These materials vary in thermal efficiency and the service, and the selection must be made on the basis of careful consideration of all the conditions.

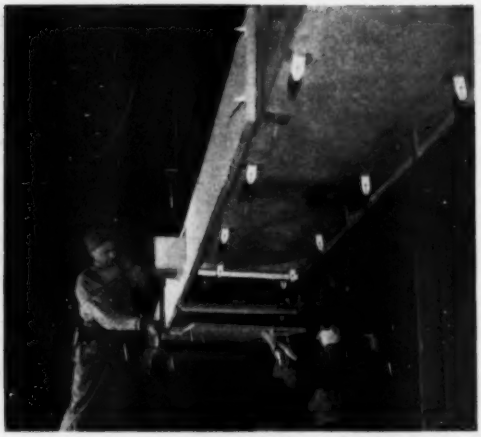
A soft blanket made of minute fibers of glass has proven a successful insulation for low temperature pipe lines, which carry brine, ammonia, and other refrigerants. Satisfactory results have been obtained when the material is applied in ½ in. thick layers to the depth required. Blankets of a greater thickness, say an inch or more, are somewhat stiff and do not lend themselves to pipe application as well. Table 2 gives the thickness recommended (in multiples of ½ in.) for different temperatures and sizes of pipe. This insulating material comes in rolls containing 200 linear ft and in widths from 18 to 54 in. Although the 36 in. width is mostly purchased, the other widths are employed to meet special conditions. Strips of a length equal to twice the circumference of the pipe are cut across the width of the roll. They are wrapped twice around the pipe and held by a spiral wrapping of jute twine or glass fiber tape 1½ in. wide. The tape is more expensive but makes possible a better appearing job, especially if it is to be finished. With this material care is taken to break longitudinal and circumferential joints.

Vapor Seals

Vapor seals must be provided to prevent the penetration of moist, relatively warm air to the cold pipe. The resulting condensation will cause dripping or deterioration of the insulation or both. One seal is sufficient for insulation thicknesses up to 2 in. Two seals, over the last two layers of insulation, are required for greater thicknesses. Vapor seals may be made of rag felt saturated with 15 lb asphalt applied over the insulation. The 2 in. side and end laps are sealed with hot asphalt. The rag felt is then covered with glass fiber fabric or 5 oz canvas thoroughly soaked with hot asphalt. This covering then receives a final heavy glaze coat of hot asphalt.

Every 25 ft length of straight piping, fittings, flanges, and hangers are divid-

Cork insulation for all sizes of pipe comes prefabricated and ready to install. The half sections are taped together tightly and wrapped with a canvas cover



Glass fiber boards are held in position with metal clips attached to duct. Outer covering can be canvas or cement

Joints are sealed with asbestos tape to insure a smooth surface for paint, which can be brushed or sprayed on

ed into isolated sections by applying vapor seal materials to the bare pipe with hot asphalt. This of course segregates any air, which may gain entrance into relatively short sections that are small enough to do a minimum of harm should moisture gain entrance. This practice makes possible the caring of air leakage as it occurs. Furthermore, necessary corrective measures are localized areas, and removing an entire run of insulation to find the source of the leak is not necessary.

Fittings are insulated separately from the pipe and with the same thickness and vapor seal. Hangers are also insulated separately for a distance of at least 12 in. from the pipe insulation. This prevents chilling and sweating.

A satisfactory final finish is to wrap 40 lb red rosin sized paper over the asphalt membrane of the outside vapor seal. A layer of 8 oz canvas may then be applied over the paper and either pasted or sewed in place. The canvas can be sized and given two coats of lead and oil paint of whatever color is desired.

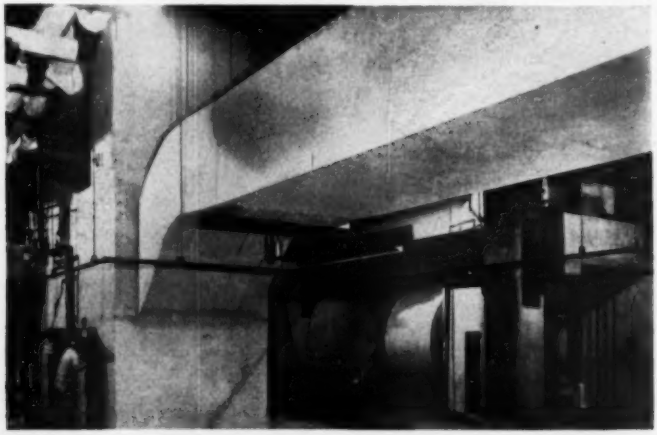
Another type of glass insulation is giving good service in cold applications. It is a light weight, rigid glass block material containing minute sealed air cells and can be worked with ordinary tools. Joints and seams must be vapor sealed with hot asphalt or asphalt cut-backs for temperatures down to -25 F. When temperatures reach -50 F, permanent mastics are used. These mastics are not adhesives so the insulation must be carefully supported.

This insulation must be held in place with corrosion resistant bands, wires, or tape. Chipped edges and voids between insulating covers must be filled with a vaporproof material such as chlorinated wax aggregate or brine putty. This type of glass insulation is vaporproof, and it does not require a vapor seal so long as the joints are properly sealed. Hangers, according to the manufacturer recommendations should be on the outside of the insulation, not in contact with the pipe. Furthermore, a non-corrosive sheet metal shield should be placed on the bottom of the pipe to prevent the hanger from cutting into the insulation.

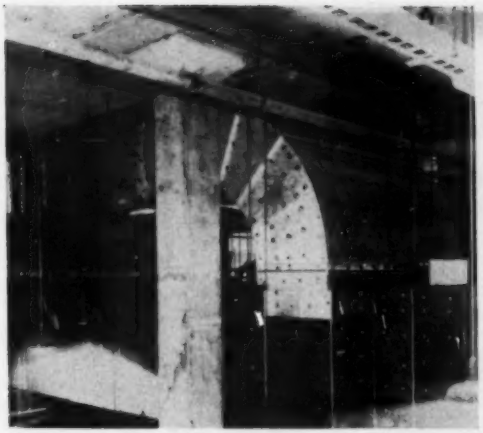
This material can be obtained factory wrapped and does not need additional finish for either indoor or outdoor application. When not factory wrapped a finish with either an asphalt base paint, asphalt impregnated felt, asphalt cut-back, metal foil, or sheet metal is required for both indoor and outdoor installations. Asphalt base or oil paint may be used to conform with color schemes.

Where the operating temperature ranges from 100 to 212 F a cement not effected by the heat must be substituted for the joint sealer. When indoor moisture conditions are severe and the pipe and fittings large, the cement must be waterproofed with asphalt paint. This procedure eliminates the possibility of condensation at lower temperatures.

For tanks, towers, and other vessels



Completed duct work installation shows uniformity of insulation application. Straight runs and irregular sections are easily covered with asbestos paint



Pressed cork board on large plenum chamber is held in position with clips, as shown on the unfinished section

Second step in insulating ducts with cork board is the base coat of asbestos or asphalt cement filler and cover

this glass type insulation has been successfully used for temperatures as low as -350 F. Multiple layers are applied, although this is an extreme application. Most frequent application is in the -50 F range, and the vessels are covered with curved segments, beveled lags, or standard flat blocks, depending on the design, or other local conditions. The joints must be carefully sealed.

Filler Application

As a rule fillers should be used for voids around flanges and knuckle radii. Although it is very resistant to moisture there is the possibility that frost and ice may form under the insulation. When the equipment is shut down, the ice melts and the water may leak out damaging the finish. Weatherproof covering is recommended for all outdoor installations.

For upright equipment a support for the first course of blocks is necessary. Blocks 9 and 18 in. high are placed alternately for the first course, and 18 in. blocks on subsequent courses so that all horizontal joints are broken. Courses are banded in place as they are laid. When the equipment is horizontal the blocks are temporarily held with rope. Joints are broken on courses, and in each layer where more than one is applied.

Flat heads are insulated with flat blocks, which have been cut to fit inside of the extended insulation of the sides. Segments for curved heads may be cut to shape at the factory and applied similarly to the side insulation, or they may be insulated with square blocks or beveled lags cut on the job. Ellipsoidal heads, or any other head for that matter, may have the insulation on the sides extended as far as the crown of the head so that a flat end piece of standard flat blocks properly cut may be used.

A non-sweat insulation for cold water lines has been developed that consists of insulating and waterproofing felts. The insulating felt provides most of the thermal insulation. The waterproofing felt protects against the moisture in the air and prevents condensation and damage from dripping. When double layer non-sweat insulation is used, the outer layer is placed so that the longitudinal and circumferential joints are staggered. This avoids through joints, which might permit warm air to reach the cold pipe and result in condensation.

Waterproof felts are placed next to the pipe, between the layers of insulating felt, on the outside of the covering, and a final one as the outer lap. A canvas jacket is placed around the outside except in outdoor locations where the canvas is omitted, and a waterproof jacket of heavy coated roofing felt is substituted. Fittings for such pipe lines are insulated with hair felt and covered with a double wrapping of spirally wound waterproofed fabric sealed with a waterproofing compound.

Water Pipe Protection

A non-frost insulation to protect cold water and drain pipes from freezing in exposed locations consists of a layer of treated paper felt next to the pipe, layers of hair felt, and several layers of paper felt. This outer jacket of paper felt and the inner layer of treated paper felt protect the hair felt against deterioration due to moisture and condensation. Such insulation is designed primarily for exposure to moderately low temperatures, and where very low temperature are encountered a built up felt construction is required.

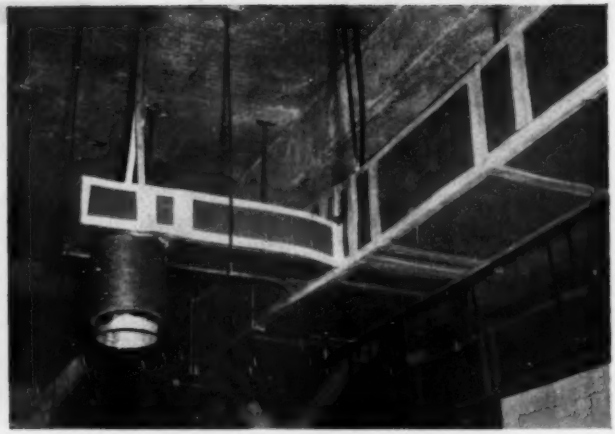
As air conditioning systems are carefully designed to provide a definite temperature with minimum variation in a given space it is good practice to insulate the ducts, especially where they are long. In this same respect refrigeration piping associated with the system should also be insulated. There are several kinds of insulating materials, and a few typical examples have been selected to show how each is applied.

Solid block type duct insulation has been installed in the General Accounting Office building in Washington, D.C. Air conditioning is an absolute necessity to ventilate, cool and heat this kind of a building. Even the exterior rooms, that contain windows, are provided with air conditioning to maintain the same uniform conditions throughout the year. Obviously, the windows are not intended to be opened under ordinary circumstances. To accomplish this comprehensive air conditioning job some 25 miles of ducts have been installed, and without adequate insulation, maintaining the desired room temperatures would be very difficult and extremely expensive.

Some of the largest ducts are the return plenums, which are 7 by 14 ft in cross-section and 250 ft long. Others are 4 by 6 ft, and of course there are many ducts of conventional sizes in the very elaborate distribution network. Corkboard insulation was used on the outside.

On large ducts and plenum chambers

Flexible glass fiber insulation is wrapped around the duct, securely tied with wire



Felt blanket insulation is readily installed with clips, adhesive paste, or wire. Joints are sealed with tape. This system will be in a false ceiling

reducing heat losses in winter and unwanted heat gain in summer is necessary. Corkboard was also used in other parts of the building for insulation to make the air conditioning more efficient. One example is the insulation of the roof, another was the cold storage rooms in the cafeteria.

Installation

Mechanical clips may be cemeted to the duct and perforate the board. The clips are bent down to hold the insulation securely in place. A fourth method consists of holding the insulation in place with cement, attaching metal corner pieces, and binding with metal bands or soft annealed wire. There are still other methods in use in special situations.

Coated insulating board may also be applied inside of metal ducts to absorb noise. When the ducts pass through areas of high humidity or carry cool air the insulation reduces condensation, and the metal of the duct acts to exclude outside vapors. On horizontal runs the top insulation is held in place with adhered clips or screws and the sides and bottom with adhesive. All joints are pointed to insure a smooth, frictionless interior surface.

Finishing an exterior insulated duct surface is best accomplished with asbestos tape applied to the corners and joints. The surfaces may then be painted. This is generally sufficient for concealed work. When the pipe is exposed, metal lath and plasterer's corner beading are wired in place, and a plaster finish is applied. Another procedure is to apply canvas or asbestos and decorate the surface similarly to the other surroundings.

Another type of insulating material widely used successfully in air conditioning is made up of the familiar glass fiber. It is effective for both thermal and acoustical insulation of ducts and pipes. It is available in semi-rigid board with a treated or coated surface for use as exterior or interior duct insulation (known as coated duct insulation) and is easily applied to irregular ducts. The board also comes without the coating for use on concealed ductwork, or where the ducts require a plaster or canvas finish cover. A third form is much like a fluffy blanket and is designed for economical application to the exterior of concealed ducts and those of circular or elliptical cross-section. None of these forms is suitable for exposure to the weather or severe mechanical abuse without adequate protection. The coated and uncoated forms should not have to withstand temperatures above 450 F, and the blanket form is limited to 600 F.

There are several ways in which the coated and uncoated glass fiber duct insulation may be applied to duct exteriors. One method is to hold the board in place with screws and washers. Another is to hold the bottom board in place with screws and washers and the sides and top with adhesive applied in strips 4 in. wide and 1 ft apart.

Vapor seals are generally required to protect an insulated duct carrying air at a lower temperature than the surrounding atmosphere. The insulation should be pointed and covered carefully with a layer of material having a very low vapor transmission rate. Pinholes and wrinkles should be avoided during installation. When the conditions are very severe, insulation applied inside the duct is preferable. The metal will then act as a vapor barrier.

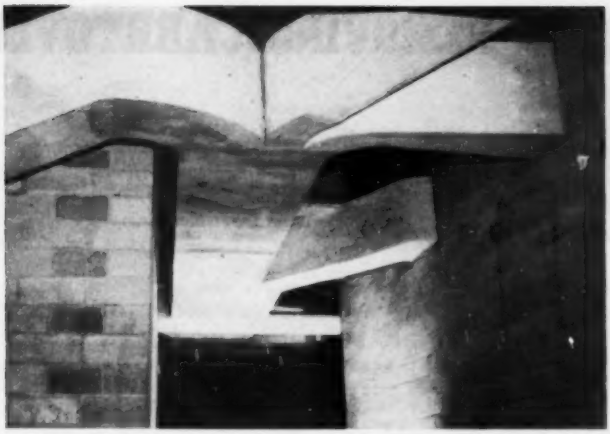
When coated insulation is placed around curved surfaces with sharp bends it is scored on the side next to the metal with a saw or knife. A saw, which removes a small amount of material, should be employed if the curve is such that the scorings are pressed together. A knife, which does not remove any material, is employed when the scorings are to be opened up. Closeness of the scorings is determined by the sharpness of the curve. If the bend is moderate, scorings may not be necessary as the board has some flexibility.

Blanket Type

Inexpensive glass fiber, in soft blanket form, can be applied to concealed ducts, whether the duct is round or rectangular in cross-section. In either case adhesive is applied in 4 in. widths 1 ft apart, and the material is wrapped around the duct with the edges butted. The insulation is then bound with glass fiber cord half hitched about every 8 in. When a surface finish is desired the insulation may be covered with canvas, asbestos paper, or a vapor barrier. The entire installation can then be painted.

This material is also a good noise absorber, especially at the higher frequencies. Transmitting of noises through the ducts from one area to another can be prevented.

Another type of glass fiber insulation is used for dual temperature such as piping carrying chilled water for summer cooling and hot water for winter heating. Glass fiber wool is formed to standard pipe sizes and bonded with thermosetting binder. It



Duct insulation, regardless of type, must be vapor sealed when covering systems handling low temperature air. Waterproof cement is also necessary

Insulation on long run pipes and ducts can be given added protection with sheet metal

can be covered with a jacket consisting of layers of kraft paper and aluminum foil to form a vapor barrier, which eliminates condensation problems. It comes in half cylinders for pipe sizes up to 12 in. and in segments for larger sizes. Longitudinal and transverse joints must be covered similarly with strips of the same material and held in place with a suitable adhesive. This insulation is recommended only for indoor use.

Rigid Insulation

A rigid type of glass material is also widely used to insulate air conditioning installations, including ducts, pipes, and pipe fittings. This material consists of minute sealed glass cells, which have a high resistance to moisture and vapor along with a very low heat conductivity. It is verminproof, fireproof, and rotproof. The product is available in sheets for application to ducts and is usually held in place with non-corrosive metal bands.

The same type of insulation is applied to piping in air conditioning installations. This material comes in half sections for the smaller sizes of pipe and in segments for the larger sizes. It is held together by copper wire or other non-corrosive materials, or it may be adhered with cement and covered with canvas. This type of insulation is also used for dual temperature piping to prevent condensation. A vapor barrier is not necessary because the material is impervious to moisture.

This material is easily worked and cut into shapes for application to fittings with ordinary tools. It is completely inorganic, is very light in weight, non-combustible, and not affected by corrosive acids. A paint finish can be applied directly on the insulation or on a canvas covering.

Another type of insulation especially developed for ductwork consists of a strong felt about ½ in. thick. A heavy asbestos membrane is woven into the felt below the soft surface. The outer top surface is of heavy woven fabric. There is a moisture resistant coating to prevent moisture absorption. This permits painting the insulation, if desired, without previous sizing. The outer surface has a neutral tan tint, which is attractive in appearance so that painting can be omitted. The material comes in 36 in. wide rolls, which contain 100 sq ft. Used as a duct lining it absorbs noise.

When applying this type of insulation to either round or rectangular ducts it is cut into panels ½ in. wider than the metal rectangular ducts. This provides an overlap and makes square corners. A special adhesive is brushed on the metal and the insulation is applied with the raw fibrous side against the metal. A roller is then applied to work the adhesive into the felt.

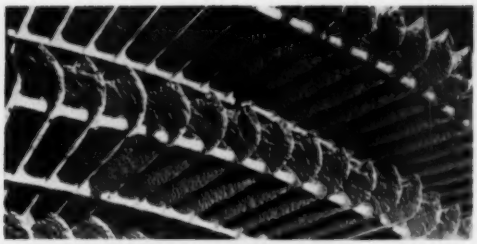
Asbestos protected tape is placed on all edges and joints. Only the white side of this tape is covered with adhesive as the other side is colored and moistureproof. The tape is scored off center so that the wider portion may be used to cover the overlapped edge. The adhesive is waterproof and resists high temperatures.

Insulation greatly prolongs the serviceability of ducts, especially those carrying cold air. Sweating is eliminated, and rusting and dripping are prevented. In addition, bare ducts carrying cool air absorb unwanted heat, which must be compensated for by having a larger cooling system.

A type of dual temperature pipe insulation made of a wrapping of creped felt forming great numbers of dead air cells is suitable for temperatures between 40 and 212 F. The product consists of an inner liner of felt impregnated with a waterproofing compound and a canvas jacket. The assembly is held in place with lacquered brass bands. The insulation is easy to install, cut and fit. Single and double layers are available in sections 3 ft long. The layers in the double insulation are of equal thickness, and the sections may be cut to permit overlapping the joints to prevent seepage of air.

Air cell pipe insulation for temperatures up to 300 F, recommended for low pressure steam and hot water lines, is made of alternate layers of corrugated and plain asbestos felt bonded together and covered with a canvas jacket. This also is held in place with lacquered brass bands and is inexpensive to install. Four to eight plies are available that are especially designed for applications that must withstand severe vibration and other difficult service conditions. One type has an outer casing of white asbestos felt with a smooth repellent surface.

For cold water lines an insulation is available that consists of insulating and water proofing felts. The waterproofing felt protects the insulating felt against moisture. There is also a canvas jacket. This type comes in single and double layers. The double layer type has a waterproof felt next to the pipe, two between the layers of insulating felt, and two over the outer layer and under the canvas.



Solids which are carried into the turbine with the steam form carryover deposits as shown in the above photograph

REMOVING CARRYOVER

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SEVERAL thrust bearing failures on insured steam turbines have been experienced during the last few years that were a direct result of solids accumulating on the blading. The salts forming these solids were carried into the turbine by the steam and a certain portion of these were deposited on the nozzles, diaphragm partitions, and stationary or rotating blading. There are a number of causes of such carryover, but the effect on the turbine is the same in nearly every case.

As deposits build up on the blading, they distort and restrict the steam path through the unit and cause additional resistance to the flow of steam. Load carrying ability and operating efficiency decreases while the load carried by the thrust bearing increases. If the thrust bearing becomes overloaded to the point of failure, the necessary clearances between moving and stationary blading are lost, and the rubbing that then occurs seriously damages the blading or wheel discs and diaphragms.

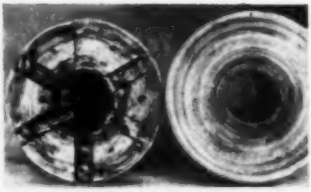
The condition of solids accumulating in the steam path is encountered most frequently during the early life of a new power plant when there are many unknown factors to be evaluated and untried apparatus to be tested and adjusted. In every instance, it is preferable to prevent deposition of solids in steam turbines rather than be forced to remove such deposits after they have been formed. First efforts to correct excessive carryover should be made by improving feedwater conditions. Using steam scrubbers in boilers generally proves to be helpful for reducing total solids in the steam. However, with some existing installations where raw water supply for the boilers is of poor quality, preventing objectionable carryover may be difficult. Usually, by carefully following the advice of a reputable water treating concern, carryover deposits can be overcome or, at least, satisfactorily minimized. Washing of the turbine blading while the unit is being rotated by steam should not be resorted to as a regular procedure to remove accumulated deposits until every effort has been made to correct the boiler water condition which causes the formation of such deposits.

In some installations, continuous carryover of a small quantity of solids in the steam supply causes deposits to build up gradually on some portion of the turbine. Some small carryover is to be expected in any boiler operating under the best conditions. This may be referred to as "normal carryover", which is a function of boiler design and solids content of the boiler water. In modern efficient steam generators, "normal carryover" may be less than 1 ppm of total boiler solids. Correction of mechanical carryover is a joint problem of boiler design and water treatment.

Some turbine accidents occur because the quantity of solids carried over in the steam increases suddenly and unexpectedly due to a failure of boiler apparatus or improper functioning of feedwater conditioning equipment. Then deposits may accumulate rapidly, and the turbine may be damaged by overloading of the thrust bearing in a relatively short time. Industrial plants often experience periods of extreme carryover as a result of priming or foaming of the boiler water. While such difficulties may have numerous causes, generally they are due to fouling of the condensate by industrial wastes or other foreign materials.

There have been instances where carryover deposits have accumulated in a steam turbine because of a failure developing in the boiler. For example, recently the thrust bearing of a 20,000 kw steam turbine was wiped as a result of heavy deposits on both the rotating and stationary blading. The boiler supplying the steam was equipped with an attemperator for superheat temperature regulation. This attemperator consisted of a tube bundle installed in the mud drum through which a portion of the superheated steam passed before joining the balance of the steam at the boiler outlet. Several tubes in the tube bundle corroded through adjacent to the mud drum head, where the concentration of total solids in the boiler is the highest. Since there is a pressure drop of about 25 psig at full load across the superheater, this condition allowed water from the mud drum to enter the superheated steam at the outlet and materially increase its solids content.

Reducing accidents caused by the gradual accumulation of deposits in the turbine begins with the prevention of carryover. Accident prevention also includes observation of turbine operating conditions as growth of deposits on the blading will be reflected by pressure, temperature and steam flow readings. Increased values of stage pressures at the same load indicate additional restriction to steam flow. An increase in the opening of steam control valves for a given load is indicative of a loss of load carrying ability which is most likely from the formation of deposits. Regular checking and logging of such operating conditions will provide data for accident prevention.



Scored runner, right, and wiped shoes, left, failed from excessive end thrust

With new installations, special attention to water treatment, steam quality, and turbine operating conditions is necessary. There may be unknown factors, such as fluctuating feedwater conditions, that will affect the quality of the steam. These factors must be evaluated before the operating procedure and feedwater program can settle down to a routine.

Sometimes deposits on turbine blading are found to be distributed uni-

DEPOSITS FROM STEAM TURBINES

formly throughout the unit. The most common situation, however, is to have deposits accumulate in some particular section of the turbine. This most often occurs about two-thirds through the steam path of condensing units, in the exhaust stages of topping turbines, or near the first few stages of the low pressure section on compound units. All types of deposits tend to build up more rapidly under steady high load conditions.

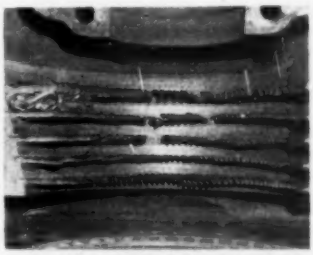
Unexpected carryover to a 10,000 kw steam turbine located in a mid-western industrial plant occurred because of adverse boiler water conditions. Heavy deposits accumulated in the vicinity of the fourth stage which imposed an excessive end thrust loading on the thrust bearing causing it to wipe. With the failure of the thrust bearing, the rotor drifted and rubbed hard against the stationary elements at which time heavy vibration necessitated a shutdown.

The boilers supplying this turbine were equipped with a conductivity meter that had an alarm. However, for some unexplained reason, steam lines to the conductivity meter were disconnected. It is believed that these lines were taken down for cleaning and were never reconnected.

Log readings showed the thrust bearing temperature had risen steadily for over 48 hr prior to the failure. Operation was continued until heavy vibration developed at which time the thrust bearing oil temperature was excessive. When the upper half of the turbine casing was lifted, the fourth stage blading was found to be 75 per cent filled with deposits which were later analyzed as 90 per cent soluble material. The third and fifth stages also had moderately heavy deposits.

The thrust bearing on another 10,000 kw steam turbine failed due to carryover deposits resulting from using water of improper quality in a desuperheater. This unit normally received its 225 psig inlet steam from the exhaust of a topping turbine but the latter machine had been out of service for over a month for a disassembled inspection and general overhaul. During this period, 800 psig 800 F TT steam was reduced to 250 psig and desuperheated. Since surface condensers are not used at this plant, 100 per cent boiler makeup water is required, and there is no ready source of condensate for the desuperheater.

Treated water prepared for use in the boilers by the well known soda-lime process was considered to be the best quality water available for use in the desuperheater. However, when operating with this arrangement, the third stage buckets became plugged to such extent that the thrust bearing was overloaded. An analysis of carryover deposits indicated they were water soluble and consisted primarily of sodium sulfate, sodium hydroxide and sodium chloride.



Contact between fixed and moving parts while operating causes heavy damage

Steam turbines that are subject to variable and low loads or frequent shutdowns tend to have water soluble deposits removed by wet steam conditions which are most likely to occur during stopping and starting cycles. The wet steam tends to produce a degree of "washing effect" that removes some of the deposits. In some cases, shutting down a turbine over a holiday has resulted in increased capacity because during the stopping and starting operation the blading was subjected to moist and relatively wet steam.

The "washing effect" produced by wet steam under certain operating conditions naturally leads to the idea of cleaning steam turbines by deliberately passing wet steam through them and thus avoid the need for opening the units to remove deposits. Deposits on blading consist of soluble and insoluble material and when water soluble, they can be removed by a suitable washing procedure using wet steam. Where a source of low pressure wet or saturated steam is available, its use will materially simplify the washing.

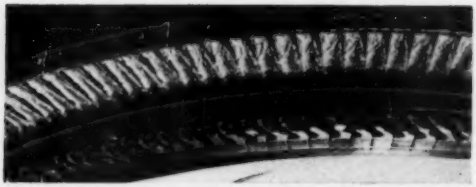
Where highly superheated steam has to be desuperheated for use in washing, specific piping arrangements must be made in advance. Hot water is introduced through a nozzle or nozzles in the steam line, preferably some distance ahead of the turbine trip valve. Usually, hot water for this purpose comes from the boiler feedwater lines.

Control of the desuperheating is obtained by regulating the amount of water flowing through the nozzles based on readings taken from a thermometer and a pressure gage installed between the turbine trip valve and turbine control valves. The turbine control valves are kept in the open position during the washing. Instruments such as thermometers and pressure gages must be reliable so washing operations can be controlled at all times. A conductivity meter should be installed in the exhaust line or arrangements made to test condensate samples for conductivity so progress of the washing can be determined.

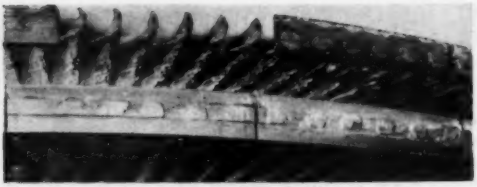
When a condition develops in a power plant where the steam turbine can no longer carry its rated load or a material loss in operating efficiency is indicated, it may be distressing to the operators, particularly if similar difficulties have not been experienced previously. Realization then comes that turbine blade deposits probably are causing the trouble. Under such circumstances, power engineers may attempt to remove solids by washing without first securing the manufacturer's recommendations on proper procedure or without providing adequate facilities for the operation.

A short time ago, an accident was experienced on a 1500 kw steam turbine generator unit that illustrates the damage which can occur to blading because of improper washing. On this unit, the fourth and fifth rows of rotating reaction blading failed, and the adjacent rows of stationary blading were practically wiped out. Blading in the later stages received severe damage as the loose blades passed through the unit. This turbine was a 3600 rpm impulse-reaction type having a single impulse stage followed by twelve reaction stages. Investigation following the accident disclosed improper washing methods had been used to remove accumulating solids from the blading which was considered to have started cracks in the blading that led to their early failure.

In this case, reduction of turbine capacity had been observed for a given valve position and it was judged that perhaps the expected blade deposits were not completely soluble in water. The washing solution used was made by dissolving 10 lb of a well known cleaning solvent in a barrel of water. This solution was introduced into the turbine cylinder through a ½ in. line between the impulse and reaction blading while the unit was operated at



When deposits accumulate to the extent that steam flow is restricted, load carrying ability and efficiency decreases



Boiler design and feedwater treatment are the main factors in preventing or minimizing objectionable solids carryover

about 1800 rpm. This procedure was rather common around similar mills in the area, and the plant management did not feel that this practice could result in a blading failure.

Representatives of the turbine manufacturer were consulted after it had been pointed out that the washing method used was considered hazardous. The plant management then advised that in the future if any washing of the steam turbine blading was required they would carefully follow the manufacturer's instructions.

It is emphasized that reputable steam turbine manufacturers do not approve or recommend any washing method for removing deposits from steam turbine blading which introduces water or any other solution as a liquid into the turbine casing while the unit is being rotated by steam pressure. Where superheated steam is the available supply, all manufacturers' instructions follow the principle of gradually reducing the superheat until the steam temperature entering the turbine is about 10 F above the saturation temperature corresponding to the pressure at that point. This is to insure that no water enters the rotating blading as a liquid. Washing is accomplished by the steam becoming wet in quality as it reaches the stages where deposits have accumulated.

When the steam supply is superheated, extreme caution must be taken to control the inlet steam temperature prior to the start of the washing because of the wide temperature change the steam turbine elements must undergo between normal operation and the process of washing. The inlet temperature must be reduced slowly and uniformly over a long enough period of time before washing is begun to insure that differential expansion does not cause rubbing between rotating and stationary parts. Similar precautions must be taken following the washing if the turbine is to return to service. In general, the recommended rates of temperature change are 50 F max in 15 minutes or 200 F in an hour for units up to 10,000 kw and 25 F max in 15 minutes or 100 F in an hour for units 10,000 kw capacity and over.

Most manufacturers point out in their instructions that some risk exists in any washing operation and all such procedures are performed entirely at the operator's risk. Since the effect of rubbing is much less if the turbine is operated at low speed, one manufacturer recommends that washing be performed while the unit is running at 10 to 15 per cent of normal operating speed. Another manufacturer recommends a speed of 600 to 800 rpm on 3600 rpm units .

It is not the purpose of this article to encourage the washing of steam turbine blading with the unit assembled but rather to point out the general fundamentals that should receive consideration before undertaking such a procedure. Very often washing equipment takes on a temporary character, perhaps with the hope it will be used but once, and as a result unnecessary hazards to the turbine are introduced. It should be clear to anyone contemplating such an operation that certain safeguards must be taken in advance of the actual washing if the desired results are to be obtained without incurring damage to the turbine.

While the foregoing discussion concerns only the removal of water soluble deposits, washing methods also have been developed for removing insoluble deposits. It is reported that a considerable number of public utility plants have removed insoluble deposits successfully by washing, primarily due to their extensive study and experimentation with this problem.

Generally, caustic washing is used to remove insoluble deposits, particularly those containing silica. This procedure usually employs a 10 per cent sodium hydroxide caustic injection solution, which introduces additional problems such as corrosion on control valve stems, packing springs, metallic packing and other turbine components. Before considering such a wash, adequate means must be taken to protect turbine parts from the action of the caustic. Careful and thorough consultation with the turbine manufacturer is required so that all possible adverse effects which caustic solutions may have on any particular turbine are known in advance of the actual washing.

Actually, a number of turbine manufacturers recommend that insoluble deposits on steam turbine parts be removed only by mechanical means upon disassembly. Scrapers, emery cloth and specially designed cleaning tools have been used extensively for removing such deposits, but often this method causes objectionable scratches on the blades. In addition, removing solid matter from the smaller blades by mechanical means is extremely difficult because these blades are very close together in the early stages of a steam turbine. Another objection to mechanical cleaning is the time consumed.

The most successful method of cleaning deposits from nozzles and blading is by blasting with fly ash in a stream of air. Dry fly ash, preferably from the base of the stack on boilers burning pulverized coal, should be used to prevent clogging. This procedure will remove deposits without appreciable loss of parent metal and leave a smooth satin finish on the turbine blades if reasonable care is taken. The direction of the fly ash jet should be tangent to the blade, nozzle entrance or exit to prevent chipping or cutting back of thin edges. In localities where fly ash is not readily available, aluminum oxide or pumice of comparable fineness can be substituted.

When insoluble deposits are found on the turbine parts, samples should be secured and analyzed. Often the information obtained will assist chemical engineers and water specialists in devising changes in the treatment process which can eliminate or minimize objectionable deposits.

It is the writer's opinion that the average plant should not consider the removal of insoluble deposits from the internal surfaces of a steam turbine by the use of a chemical solution while the turbine is being rotated by steam. When turbines are disassembled for general overhaul, blades and nozzles can be cleaned of all accumulated deposits. Soluble deposits can be removed by using a strong jet of compressed air and water, and insoluble deposits can be removed by mechanical methods or blasting with fly ash.

PROFITS FROM WASTES

Operating costs of the ion exchange system for chromate recovery described in this article are approximately $17 per day including regenerant chemicals, equipment amortization and estimated resin replacement. The disposal method previously used cost $63 per day

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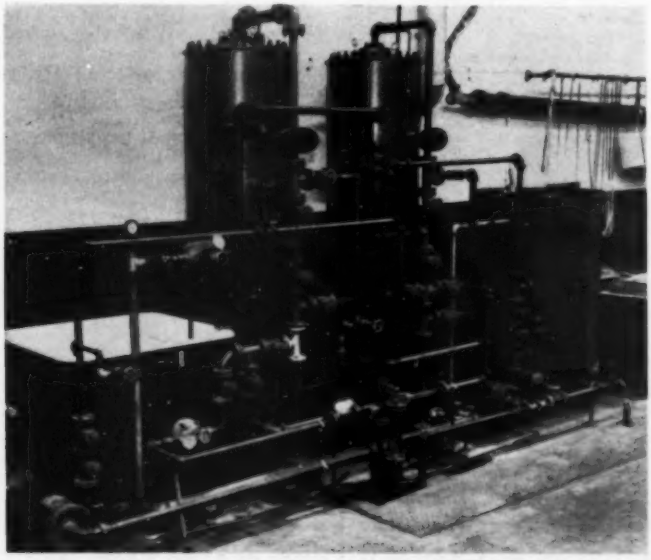
Research Engineer
Special Applications Dept.
The Permutit Company

IN CHEMICAL OPERATIONS, few jobs cause the engineer so much grief as separating valuable substances that should be reclaimed from those which must be discarded. Problems of this type range from taking minerals out of boiler feedwater and cleaning up plant wastes to the profitable recovery of valuable materials. In the last few years, engineers have discovered that one excellent way to do these jobs and many others is to apply ion exchange systems.

Ion exchange can be considered an economical method of treating wastes when valuable material can be recovered for re-use. However, it must be remembered that the regenerant solution produced through the exchange of ions should be of a readily disposable nature and character. Certain types of chemical wastes can be purified by ion exchange, producing a valuable effluent for re-use, but the regenerant effluent would be just as harmful for discharging as the original waste itself.

With federal, state and municipal governments becoming increasingly alarmed and concerned over pollution of streams, rivers and other waters, industry is being forced to pay more attention to the treatment of harmful wastes. In other instances, shortages caused by the Korean situation have intensified the importance of recovering certain materials, particularly chromium and chromic acid. The squeeze on these critical materials has created demands for equipment to recover chromium-containing ions from baths employed for anodizing aluminum, chromium plating and copper stripping. In these aforementioned processes, chromic acid becomes contaminated with metallic cations, lowering its effectiveness and requiring replacement as a certain amount is lost through dragout on the surface of the work.

Wastes resulting from these sources have always been an expensive nuisance. Recently, with more attention being forced on stream pollution prevention and the critical need for chromic acid, a variety of disposal methods have been considered and installed.



Two units, fabricated of steel with flame sprayed polyethylene linings, recover chromate by ion exchange. Pipes and valves are steel, lined with Saran rubber

During anodizing treatment, chromate reacts with the metal surface dissolving some of the metal and producing trivalent chromium from the hexavalent form. For the several processes, such as bright dipping or copper stripping, this is necessary. But, for other operations, such as electroplating, it is an unnecessary side reaction to the processing steps. However, in all processes, the reaction results in consumption of the acid and produces a chromate salt which cannot be reused. This solution is highly concentrated, difficult to dispose of and toxic.

One process known to be operating on a commercial scale, eliminating stream pollution and returning the chromate in usable form to the treatment tank is an ion exchange method which utilizes synthetic resins. This system for supplementing chromate waste disposal facilities and recovering chromate in useful form has several advantages. They are: (a) initial installation costs are 50 per cent lower than the cost of conventional disposal equipment, (b) operating costs are 75 per cent less, (c) approximately 80 per cent less floor space is required, (d) consumption of strategic materials is reduced 90 per cent, (e) water and steam consumption is 85 per cent less, (f) better plating and anodizing efficiency is obtained, and (g) higher quality finished products are assured.

Fig. 1 illustrates the system which consists of a cation exchanger to remove metallic cations from the strong chromic acid anodizing solution and an anion exchanger to recover chromate from dilute rinse solutions. One ion in solution is exchanged for another by an insoluble granular material which can operate in a reversible manner. In this process, the desirable exchange reaction is hydrogen ions for metallic ions. The cycle is completed by utilizing ion exchange resins for recovery of chromium ions. It is the first complete ion exchange chromate recovery process to be used on an

anodizing line. With a year of satisfactory operation at the plant of a leading aircraft manufacturer, great savings have been realized.

The anodizing bath is operated at a pH between 0.7 and 0.9 and 50 to 70 grams per liter of CrO_3. Each day, a portion of the bath is withdrawn and passed through the bed of a high capacity cation exchanger. All aluminum and other metallic cations are removed from this portion and hydrogen cations are substituted. Effluent solution having a very low pH is returned and mixed with the remainder of the chrome bath, lowering the over-all metallic content and pH somewhat. Anodizing is not interfered with in any way and can be continued during the treatment process.

This cation exchange unit was sized so that operation once a day is sufficient to maintain the metals at a reasonable level. Experience has shown that pH in the bath can be held within very close limits and very little CrO_3 must be added. As high metallic concentration is permissible in the anodizing tank, it is only necessary to remove and treat a small fraction of the total bath to maintain satisfactory conditions. The treatment cycle is short, commonly taking less than one hour.

When the resin becomes exhausted, it is regenerated by contact with sulfuric acid. The effluent sulfuric acid is sent to waste, carrying with it the metallic cations. This acid is then washed from the unit with water. It is necessary also to displace the chromic acid with water and this results in some desirable dilution which compensates for dragout and evaporation losses in the bath.

Normally, incorporation of a "save rinse" tank will conserve from 60 to 90 per cent of the chromate being dragged from the treatment tank. The remaining chromate, however, still requires treatment, and ion exchange offers a very satisfactory solution here as well. Instead of sending the rinse water to treatment and thence to waste, it can be sent through the bed of an anion exchanger, which has the property of removing chromate ions and substituting hydroxyl ions.

When treating virtually pure chromic acid, this results in the formation of water in place of acid. Since the equipment also is capable of operating as a water demineralizer, the rinse tank is made up initially with demineralized water. Hence, when chromic acid is removed, demineralized water remains that can be returned to the rinse tank for re-use. This conserves water, and in some cases where hot rinses are used, on the heat in the water, and simultaneously offers the manifold advantages of demineralized water for rinsing. Treatment flow rate can be controlled so that the rinse tank pH is kept at the value which gives the most satisfactory surface.

When the anion resin becomes exhausted with chromate, flow is either halted or shifted to an alternate unit, and the resin is regenerated with caustic soda. Caustic soda drives out chromate anions and replaces them with hydroxyl anions. The effluent solution from the unit is alkaline and contains all of the chromate. For this installation, only passing the alkaline regenerant effluent solution from the anion exchanger through the cation exchanger is required. Here the sodium ions are removed forming free chromic acid. This solution can be returned directly to most anodizing and stripping baths, but return to plating baths may require some evaporation.

Records of the bath under present circumstances, as compared to similar figures before the recovery equipment was installed, indicate that the equipment saves more than 100 lb of chromic acid per day. Heat and water also are conserved and, less the cost of repumping the water, amount to about $4 per day. A conventional treatment plant for holding, reduction of chromate, and neutralization would cost several times the price of recovery equipment and would have an operating cost for chemicals in excess of $20 per day plus the cost of an operator. Recovery equipment may be installed right in the plating room and operated by production personnel so no labor cost is involved.

Operating costs of the recovery equipment at the aircraft plant are approximately $17 per day including regenerant chemicals, equipment amortization and estimated resin replacement. This compares favorably with the disposal method, which costs $63 daily. Resin replacement can only be estimated as there has been no need for replacement as yet. Fig. 2 summarizes these costs on a daily basis.

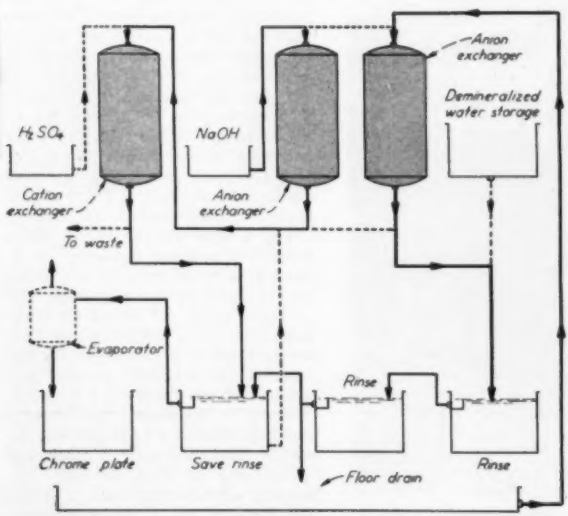


FIG. 1—FLOW DIAGRAM OF ION EXCHANGE CHROMATE RECOVERY SYSTEM

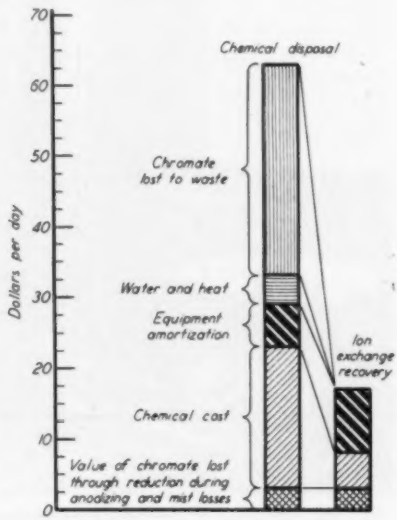
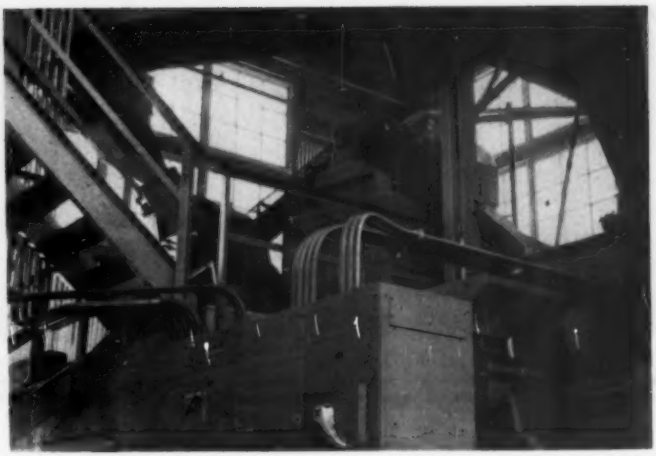


FIG. 2—COST OF DISPOSAL AND RECOVERY

This installation in a small western plant was designed to coordinate the electrical system with process steam and industrial air, producing nearly automatic operation. Waste product fuel and re-use of steam condensate add to the efficiency of operation

PAUL H. GILLEM



Trouble anticipated from intermittent load on chipper was answered by use of a wound rotor motor. The chipper house, right, also illustrates how equipment is enclosed for employee safety

Power and Processing Systems

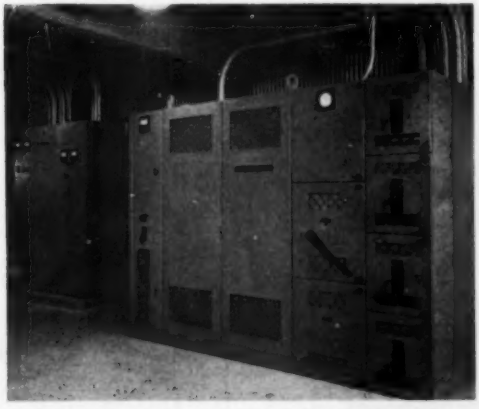
MAKE ALLWOOD PLANT SEMIAUTOMATIC

MANUFACTURE of 180,000 sq ft of various types of hardboard has recently been made possible by the Oregon Lumber Company plant built at Dee, Oregon. As a small manufacturing plant, it is unique in that sawmill waste in the form of whole slab, previously burned as unwanted refuse, is now converted into high quality hardboard.

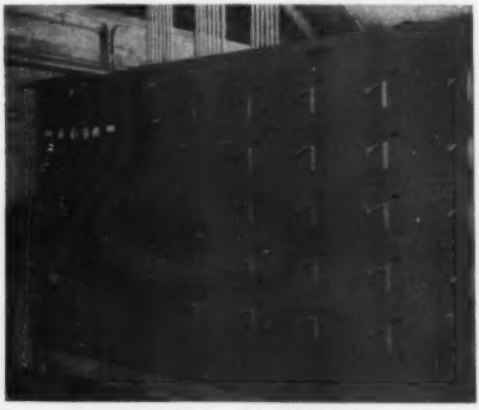
As an industrial plant, it is even more notable in the degree to which modern electrification and the application of steam generating facilities have enabled the plant to operate on a virtually automatic basis. Raw materials are completely processed without manual handling and with a total operating force—including supervisory personnel—of only fifty employees. It is estimated that each 1,000 sq ft of 1/4 in. hardboard produced in the plant requires only 0.75 ton of slabwood, 2500 gal of makeup water, 2500 lb of process steam, 375 kwhr of electric power, and 5 hr of labor.

The plant's total connected electrical load, including lighting, is approximately 3000 hp. Electrical power requirements called for a 2300 v, three phase delta system, with an underground service from the adjacent sawmill's two turbine generators, rated 2550 kw and 750 kw, respectively. Two, three conductor, 5 kv varnished cambric and lead cables, 500,000 cir mil size, are used in multiple for this service.

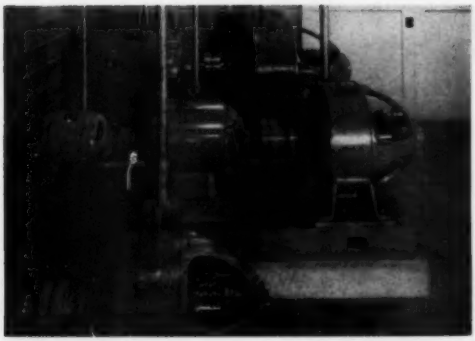
Power is distributed in the plant at



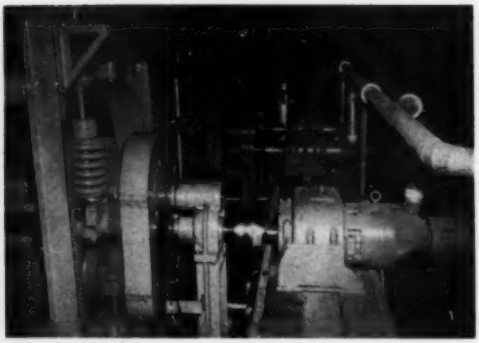
Power is distributed to the plant at 2300 v for the larger motors, including the motor generator set for d-c, and at 440 v from the main switchgear for the rest of the load



A centralized control center is the focal point of plant operation with an integrated system of interlocking controls that synchronizes operation of processing machines



A motor generator set provides 135 kw d-c for the plant, particularly for the adjustable speed drives on the board forming equipment. Rotating regulators control roll speed



D-c tachometers mounted on section motors generate voltage proportional to speed. Compared to a reference, any difference is amplified by regulators, left, to readjust speed

2300 v, three phase and 440 v, three phase, with a 1000 kva unit substation for the 440 v power. The power center, containing an air-cooled transformer and enclosed, low voltage circuit breakers, feeds circuits protected by molded case, low voltage air circuit breakers.

A motor generator set, operating at 2300 v, supplies 440 v d-c power for the rotating regulator controlled equipment on the board forming machine. A continuous felt-like mat of wet pulp is carried along at an adjustable speed range of between 10 and 80 fpm, requiring driving motors and speed reducers controlled automatically within close limits. Each motor holds a speed in reference to the adjacent driving sections so that there will be no draw or tension on the mat.

The relatively minor problem of shock loads on the large slab chipper was solved by the installation of a 200 hp wound motor, found to be capable of reasonably sustained speeds despite voltage dips from sudden changes in chipper loads.

Of the 87 electric motors in the plant, 26 are gearmotors of from 1 to 10 hp for low speed, high torque requirements; high speed needs are handled by 61 general purpose and special duty motors ranging from 3 to 450 hp.

Process steam is supplied from the main boiler of the company sawmill, with a 20,000 lb per hr boiler as standby. The main boiler, with a total capacity of 78,000 lb per hr of steam at 250 psig, supplied through a superheater at 440 F, is fired by rejects and trimmings from the hardboard plant as well as by short cuttings and slivers from the sawmill.

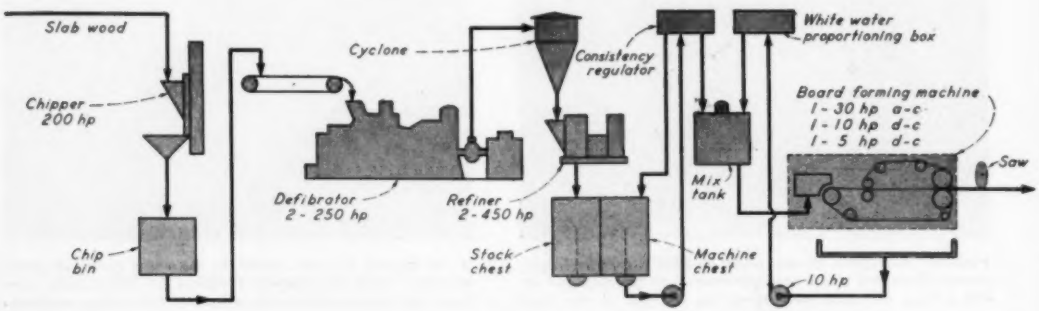
Efficient re-use of steam condensate from the pulping, grinding and pressing processes is a unique feature of plant operation. Process steam used in these manufacturing steps requires a maximum pressure of 175 psig and following processing is pumped back to the boiler for re-use. The condensate exhausted by the hot press during operation is also sent to the boiler for reconversion.

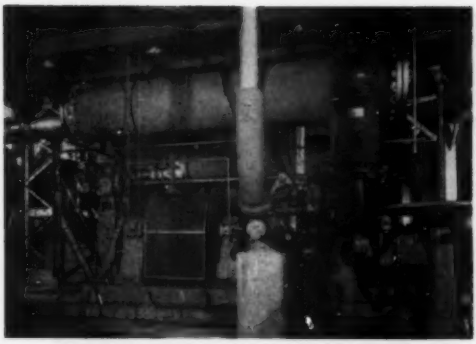
Manual handling of wet panels which have been trimmed to 16 ft lengths on the board forming machine is obviated by air actuated transfer machines that transport them to the hot press loader. A special problem was lifting the fibrous, watery panels onto carrier screens that convey them through the pressing operation. For this purpose, a vacuum transfer was designed. A suction head lowers over the panel and lifts it clear of the speed-up rolls that bring up a carrier screen and position it directly beneath the raised panel.

As soon as the screen is in place, suction is released and the panel drops onto it, ready for removal to the press loader. Although the economies of most production line problems favor the electric motor, transfer of these flimsy mats proved to be a special case. Mechanical lifting was out of the question, so this handling means was devised to raise them.

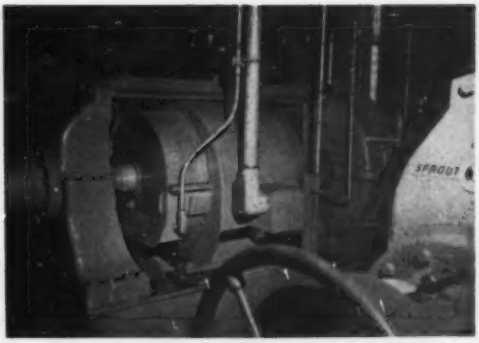
This new hardboard mill coordinates industrial air, steam and electrical power to a degree of efficiency not often found in small plant operation. Modern methods and equipment, skillfully applied to the problems at hand, make possible an efficient operation at high production levels, with production costs well below those of many plants of comparable size.

Four photographs on these pages are supplied through the courtesy of THE LUMBERMAN.

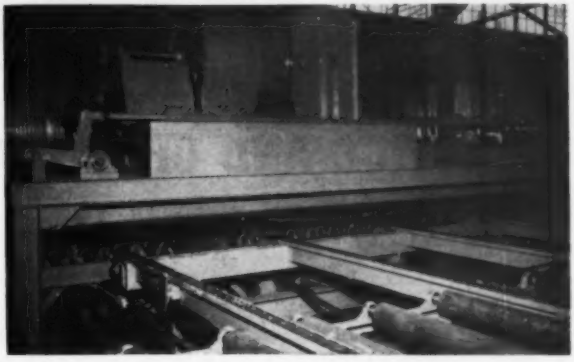




Process steam softens chips in upper defibrator chamber for 1 min at 140 to 175 psig. Chips are then discharged to grinder below which is powered by 250 hp direct-drive motor



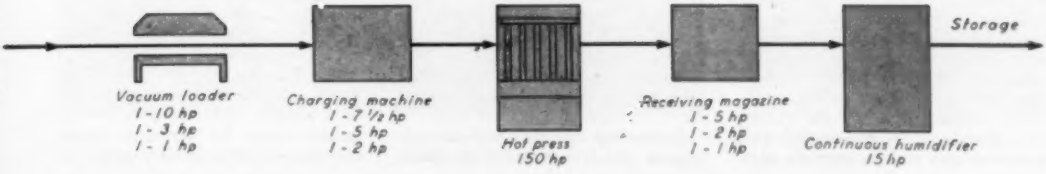
The refiners, which complete the grinding and pulping processes, are driven by the largest motors in the plant. Synchronous motors rated 450 hp were selected for the job



Trimmings and rejected mats from the board forming machine are shredded in a beater, above, having a 60 hp motor

Transfer machine, right above, employs suction to raise the soft pulpy mats for transfer to screen cauls. As shown in the photo, caul is entering from the right. When screen is positioned, the rolls will stop and suction will be released. The transfer chains in the foreground will carry the pulp mat and screen to the press charging machine

The circular chamber in the view at right is the humidifier where panels are seasoned for dimensional stability



Inside view of wet blasting chamber as operator cleans a production tool

SERVICE AND OPERATION SIMPLIFIED WITH WET BLASTING

Increasing the life of production tools, such as dies and molds, has been made possible with wet abrasive blasting. Items are cleaned in one operation without fear of tool damage. Fatigue cracks in dies and molds are easily detected by visual inspection

EUGENE ANDERSON, ***Engineer***
American Wheelabrator & Equipment Corp.

FOR YEARS, only manual cleaning and finishing methods were thought to be gentle enough for maintenance of precision-built plant equipment, but the introduction of wet abrasive blasting dispelled this idea. Wet blasting offers extremely close control over surface abrasion, and as a result, it has eliminated many manual surfacing operations and brought about important economies.

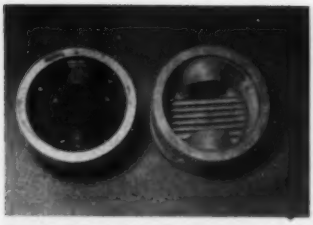
In wet blasting, very small sized abrasive particles in a water suspension are hurled upon the work at high velocity, but since such very fine mesh abrasives are used tolerances of 0.0001 in. are easily maintained. Sharp edges or corners on work withstand many cleanings without being dulled, and lines or lettering on parts such as molds and dies remain unchanged. Flat surfaces are not "dished", and knurled work can be cleaned without dulling the points.

Probably the widest application for the wet blasting process in the maintenance field at the present time is the redressing dies and molds. Typical examples are plastic molds, glass molds, forging dies and die casting dies. They later become covered with a carbonaceous scale, due to the high temperatures of forming operations and hydrocarbon lubricants. In all of these cases, scale removal is important, especially from corners and crevices in the die or mold. When allowed to remain the scale continues to build up, acting as part of the die or mold and eventually affects the shape of the molded parts.

Other contaminants present themselves also, such as: collected plastic on plastic molds, clinging rubber on rubber molds and adhering metal on bearing surfaces of extrusion dies. Proper cleaning of plungers and other related parts also makes molds operate more efficiently and reduces wear.

Performing this work with abrasive papers, wheels and polishing stones was slow because of the number of steps necessary. First, coarser abrasives needed to be applied, then progressively finer ones. Considerable maintenance of polishing stones was necessary to keep them dressed to fine points for crevice cleaning. Even then, hand finishing often resulted in removal of too much metal, so that parts like multi-cavity extrusion dies become unbalanced. Jointed molds sometimes had to be disassembled so that all areas could be adequately cleaned. Disassembly is now rarely necessary.

Wet blasting has eliminated all of the manual polishing, except on surfaces where a mirror finish is desired. In this case a few steps of manual finishing are subsequently required. A



Grease, from the crankcase side, and carbon, from the compression side, on

this piston were removed by wet blasting. Cleaning time for inside and cap

was 11 min, the outside cleaning was accomplished in 6 min of blasting

lustre quickly comes up on a wet blasted surface because all imperfections, such as tool marks, scratches or grinding lines have already been blended together, and manual polishing is begun on a perfectly uniform matte finish.

As a rule, mirror finishes are put on molds or dies only because a smooth surface is desired on the molded part. Smooth inside surfaces do not add to final product appearance, so mold faces for them can be left in the wet blasted state. On parts like punches for plastic or glass molds, matte surfaces from wet blasting are actually preferable, because with directional lines eliminated they offer better release of the molded part than do polished surfaces. In forging, extruding and some die casting plants, matte surfaces of the proper texture are put on all parts of the dies, since they hold lubricants very well and virtually eliminate die break-in time. Some die casters report that they need less pressure on the molten metal when matte surfaced dies are used.

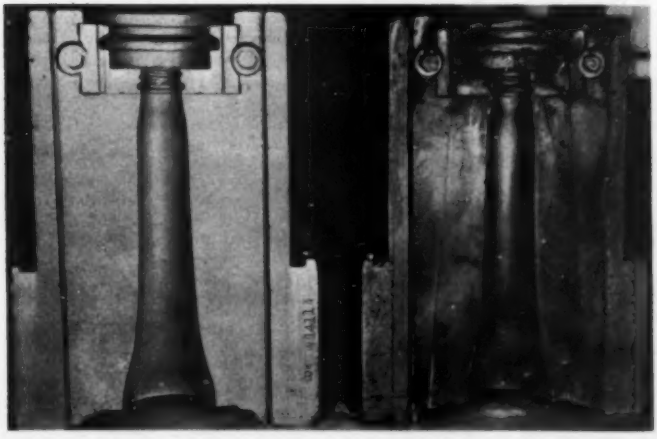
Detection of fatigue cracks or other defects during inspection is easier after wet blasting since amorphous metal resulting from polishing is not present to disguise the surface. Close examination after cleaning means that molds, which need repair can be taken care of before time and material are wasted in the forming operations. Repair workmen like matte surfaces to work on because they produce no fatiguing glare under lights as do polished ones.

Tool maintenance has also profited from wet blasting, particularly in plating operations where worn tools are rebuilt to specified tolerances. In these applications, blasting is done twice, prior to and after plating. Blasting provides the matte finish to which plating can be strongly bonded. It also removes wire burrs, which form during re-sharpening.

Blasting after plating makes a tool operate at peak efficiency virtually from the minute it is put into service. Lubricants tend to bead up on glossy surfaces so that not all areas are evenly wet, but a matte surface holds lubricants well all over the surface of the tool, and friction effects are minimized. Because of this, metal chips from cutting operations are easily eliminated through the flutes of the tools, and the galling frequently experienced with drills and reamers, especially when cutting plastic material or non-ferrous metals, is greatly reduced. Tool loading frequently encountered in machining cast iron is also very greatly decreased.

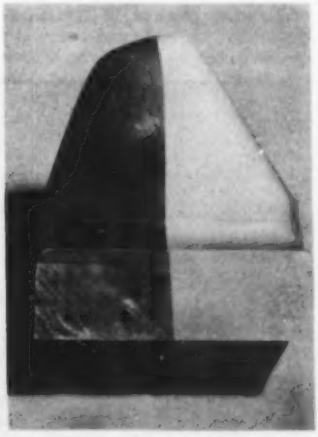
Some shops report that wet blasting makes a reconditioned tool more readily accepted by an operator because of its improved appearance. As one owner says, "Wet blasting gives the first-class appearance that should go with a first-class job. Even in tools, appearance is an important point in selling the operating department on your process".

Wet blasting has reduced overhauling and reconditioning time for power plant engines. Pistons, valves, master and articulating rods are all cleaned of carbonaceous deposits in a few minutes. Wet blasting has one important

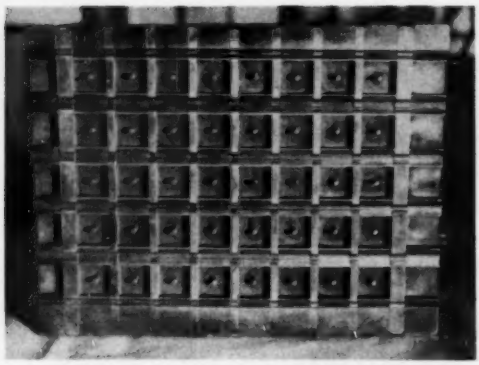


Bottle mold half on left redressed with wet blasting in 3½ min reveals

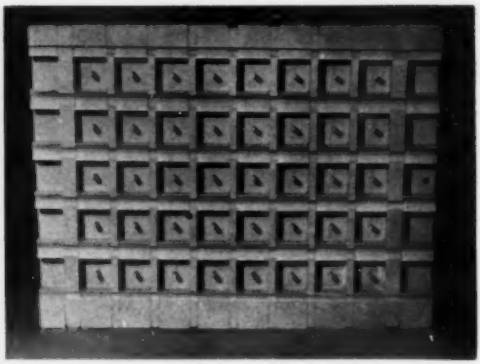
heat checks in metal. Parting edges remained sharp during this process



Left half of this mold was masked to show contrast of dirty and clean area



Carbonaceous scale on this rubber mold can be the cause of production rejects resulting from surface imperfections



Same mold, on left, after being wet blasted for 16 min, 45 sec. Surfaces are clean, and mold is ready for production

advantage over dry abrasive blasting in this application. With dry blasting, grease, oil or other viscous deposits have to be thoroughly removed by chemical means before the blasting operation so that the abrasive particles will not agglomerate. With wet blasting, the thorough removal of these materials is not necessary before the blasting operation.

Operation

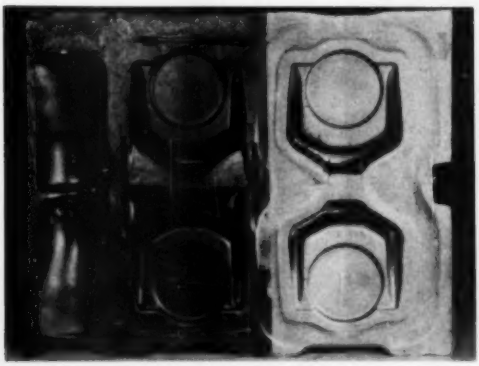
Wet blasting is done in metal cabinets, sized according to the requirements of the job, and the slurry mixture is propelled at the work through a gun. The abrasive is kept in suspension by means of agitation from either compressed air or a recirculating pump. The trend has recently been toward vertical centrifugal pumps as they require only ½ hp as compared to 2 to 5 hp for compressed air. Furthermore, they need virtually none of the maintenance required by horizontal-type pumps. When blasting is carried on, 80 to 100 psi air is blown through a suction-type gun to give the abrasive slurry the velocity necessary to effect a cleaning action. The operator stands outside of the cabinet with his arms extended through armholes on the front of the machine. He manipulates the gun and work inside the machine with his hands while operating the compressed air by means of his knee. The abrasive gun is held approximately 1½ to 2 in. from the work and at an angle of around 60 deg with it.

During the wet blasting operation, the operator is able to view the progress of his work through a vision window. The work is inserted into the cabinet and removed through doors located at the ends. However, small work such as tool bits, glass mold neck rings can be inserted and removed through the armholes. This procedure is only possible if the gloves can be unattached to the gauntlets. Unattached gloves have been more popular than attached gloves, and each workman can have his own pair for avoiding contagious skin diseases.

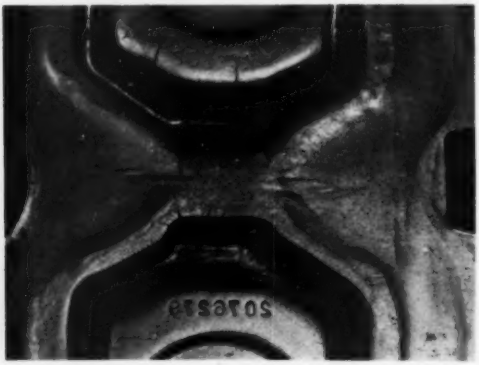
Machine Type

Various types and models of machines are available for the blasting operation, along with various kinds of accessory equipment, depending upon the application and requirements of the work. Machines range in size from small bench models to large floor models having two sets of armholes and accommodating two operators at once. Dimensions run from approximately 30 in. in length to slightly over 6 ft. The most popular size for general work is a floor model about 4 ft in length and 3 ft in width with one set of armholes to accommodate one operator.

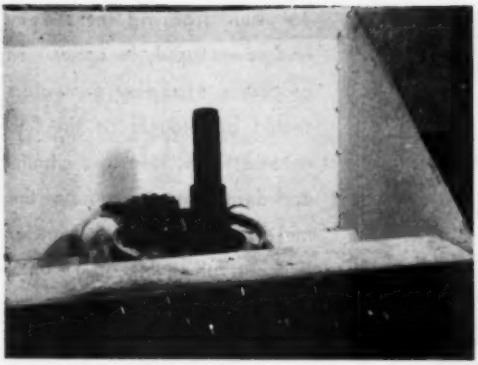
The work conveyer inside the machine depends upon job requirements. Where only small work, which can



Forging die, covered with rust, was masked to show relationship of cleaned portion after 2 min, 8 sec of blasting



Close-up of the wet blasted forging die, on left, shows how heat checks in the metal can be easily inspected



Items to be wet blasted are placed on a work car, which rests on a track, and pushed into the blasting chamber

This wet blasting unit has a power rinse tank for washing blasted items. Tank also facilitates handling heavy parts

easily be lifted and turned by hand, is to be cleaned no work conveyer is employed. An expanded metal floor in the blasting compartment is all that is necessary. The operator merely turns the work over in his hand or on the expanded metal floor. Where heavier work is to be cleaned, the cabinet is provided with a work car mounted on tracks. This car can be also equipped with a rotating turn-table, which greatly facilitates manipulating work in front of the gun.

Operator reaches into rubber shields and wet blasts objects while viewing through window. Items can be positioned with one hand while nozzle is being held and directed with other

Rinsing

After the blasting operation, the parts are rinsed, either in hand rinse or power rinse tank, while ferrous parts are rinsed in inhibited water. The hand rinse tanks are usually for the light work. Rinse tanks are generally made available in pairs, one compartment for receiving the part immediately out of the blast chamber and the other for a final rinse. For heavy work, such as forging dies and rubber molds, a power rinse tank is available that has tracks on which a work car can be operated. The manner in which this tank is used depends upon the metal of the parts that are being blasted. When nonferrous metals are to be rinsed, the tank can serve merely as a means of supporting the heavy work, and the parts are rinsed in tap water through a hose. Where ferrous metals are to be rinsed and inhibited water is necessary, the tank is filled with water and inhibitor, and a coolant-type pump raises this water through a hose. Power rinse tanks are convenient when chain hoists and other lifting devices are needed for heavy and bulky work.

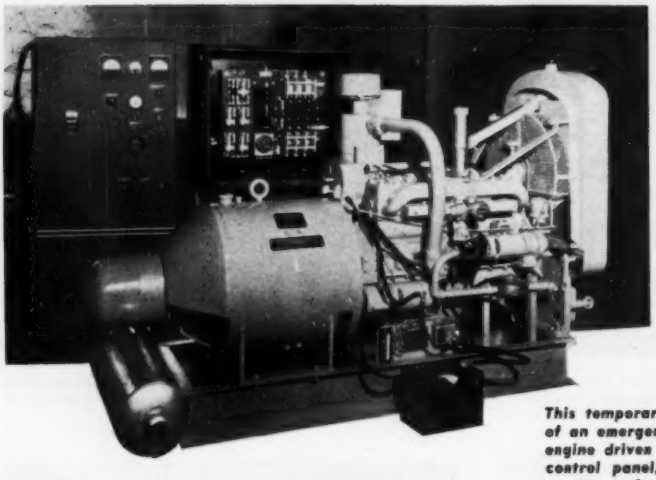
Both the hand and power rinse tanks are available with immersion-type water heaters. Hot water makes parts dry faster, and there is less chance for oxidation.

Job and captive maintenance shops, having a wide variety of work requiring various types of abrasive, have found that two blasting machines with one power rinse tank in between makes an economical assembly for maximum versatility. Furthermore, down time for changing the abrasive is reduced. A different size of abrasive can be employed in each machine, and one work car is sufficient to serve both.

Abrasives

Various types of abrasives are available for the different applications. Due to the popularity of the process, all sizes of silica-type wet blast abrasives from 80 to 2500 mesh can be obtained directly from manufacturers' stock. The special chemicals required in wet blasting are also available. Anti-packing chemicals are available that keep the abrasive particles from settling into a solid mass on the bottom of the hopper when the machine is shut down. This chemical is not always needed, as abrasive packing depends upon the hardness of the water utilized. Among the newest developments in rust inhibitors is a liquid-type inhibitor, which goes into solution immediately. According to laboratory tests, it is said to virtually eliminate the staining normally expected on rinsed work. Abrasives can be obtained in any size or coarseness.

Wet blasting's rapid rise in popularity has been aided by the attention given by manufacturers of the equipment to technical research for the customer. Customers can, before investing in wet blast equipment, have typical parts, which they would clean on a production basis sent to the manufacturer's demonstration laboratory. Various tests are then made to see what equipment design is most suitable for the job, and what abrasive gives the best results. Each application in wet blasting has its own peculiar characteristics, and such a laboratory is a valuable aid in determining the most efficient equipment and proper abrasive to meet requirements.



To insure lighting for safety and power supply for continuous processes, standby generators should be brought on the line automatically. Here are circuits and descriptions of some of the most common types of transfer switches for engine driven units

FRANK E. REEVES
Electrical Engineer

This temporary arrangement illustrates all components of an emergency system. The 50 kva, three phase, gas engine driven generator supplies 120/208 v power. The control panel, with 150 amp switch, contains all the necessary functions, test-runs set 30 min every day

Automatic Controls for

ENGINE DRIVEN STANDBY GENERATORS

LOW VOLTAGE AUTOMATIC transfer switches are used to transfer lighting and small power loads from a normal source, when it fails, to an emergency supply. The normal source is usually a utility service; and the emergency supply may be another utility service, a battery, or an engine driven generator. When the last named equipment is used, the engine must be equipped for automatic starting, preferably furnished by the manufacturer as an integral part of the emergency power unit.

Two methods of starting engine generator sets are commonly used:

1. By closing a contact, the engine will start automatically and remain running until the contact is opened, and

2. Grounding a terminal on the generator set will start the engine automatically. When it has attained speed, the ground should be removed. To shut down the set, another terminal must be grounded, and may remain so while the set is not in use. The ground must be removed before the engine may again be started.

The second method requires a somewhat special scheme, if automatic starting and stopping is to be accomplished by the transfer switch.

Automatic transfer switches are available in two broad classifications: (a) magnetically held, and (b) mechanically held, electrically operated. The former type is cheaper, but has certain disadvantages and limitations. It can consist of two mechanically interlocked contactors, or a straight double throw design. The latter has the advantage of having no neutral position in which the load would not be energized from either source, as in case of holding coil burnout. A disadvantage of a magnetically held transfer switch lies in the fact that the holding coil is energized continuously while the normal source is alive. In a-c applications, this might be objectionable due to continuous hum.

In Fig. 1, a magnetically held automatic transfer switch with engine starting contacts is shown. The switch position illustrated connects the load to the normal source. When that fails, the holding coil becomes de-energized, the contacts drop by spring and gravity action, and the load is transferred to the lower contacts connected to the standby generator. Simultaneously, the engine starting contacts, mechanically joined to the main contacts but electrically insulated therefrom, close.

The arrangement shown in Fig. 1 can successfully be used only with very small generators, usually not exceeding ½ kw, because the load is thrown directly on the generator before the engine is started. Of course, at zero speed there is no load, since there is no generated voltage; but as the voltage starts to rise, the load appears. This disadvantage could be overcome with a field contactor which would not close until speed and voltage are attained.

However, for the larger sized generators, a mechanically held transfer switch, Fig. 2, is usually preferred. In the switch illustrated, transfer of power contacts is effected by a solenoid-operated rotating weight.

The solenoid (designated *Operating coil* in the diagram) starts the weight

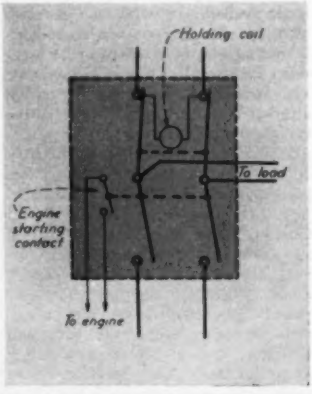


Fig. 1—This circuit for a magnetically held transfer switch starts the engine under load, is used on smaller units. For larger units, controls like that in photo above may include test switch to simulate power failure or to test engine without load transfer as well as time delay for retransfer to normal

in motion, and, at a critical point in the travel, is de-energized. The weight then completes contact operation by mechanical inertia alone. This permits transfer of the control contacts and sets up a circuit for the operation of the switch in the reverse direction.

The transfer switch in Fig. 2 is shown with the load being fed from the normal source (bottom contacts closed) and the engine generator not running. When the normal source fails, the transfer relay, whose coil is fed from the normal source, drops out, and its bottom contacts close. The main contacts do not transfer at this time, since the operating coil is energized from the engine generator. However, the engine starting contact on the transfer relay closes, and the engine is started.

Transfer of the load is usually delayed until the frequency and voltage produced by the generator are near normal. One method uses a tuned supervisory relay whose coil is connected, in series with a capacitor, across the transfer switch terminals fed from the generator. The value of capacitance is selected so that the coil circuit is sharply resonant to 60 c (or other normal frequency). The pick-up value of the relay is adjusted so that the contacts will close only after frequency and voltage are close to normal, when the load will be transferred to the engine driven generator.

A two pole switch is illustrated, but units with more poles are available. If both sources are 220 v, three wire a-c, both neutrals would be tied together. If one source is d-c, a three pole switch would be required by the National Electric Code, as the neutral must be broken by the switch.

In a three phase application, supervisory relays may be added to provide for transfer if any phase drops to a definite percentage of the normal value of voltage.

A time delay relay may also be added to prevent transfer of the load on very short outages. It is particularly desirable where an engine driven generator is used as the emergency source. Frequent voltage dips or short time outages such as might occur during lightning storms would cause unnecessary wear and tear on the starting equipment, as well as discharge the starting battery.

The preceding circuit is satisfactory for the first of the two engine control methods listed at the beginning of the article. When a engine generator set which employs the second type is to be controlled from an automatic transfer switch, the scheme shown in Fig. 3 may be used. Design of the transfer switch is identical with the one in Fig. 2, but the switch panel control wiring is omitted to simplify the diagram.

When the normal utility source

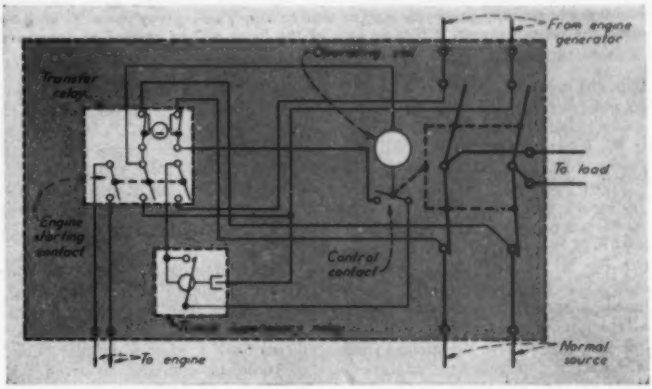


Fig. 2—In this type of mechanically held switch, the transfer relay starts the engine but the main contacts, carried on a rolling weight impulsed by the operating coil, do not close until the supervisory relay pulls in at full voltage

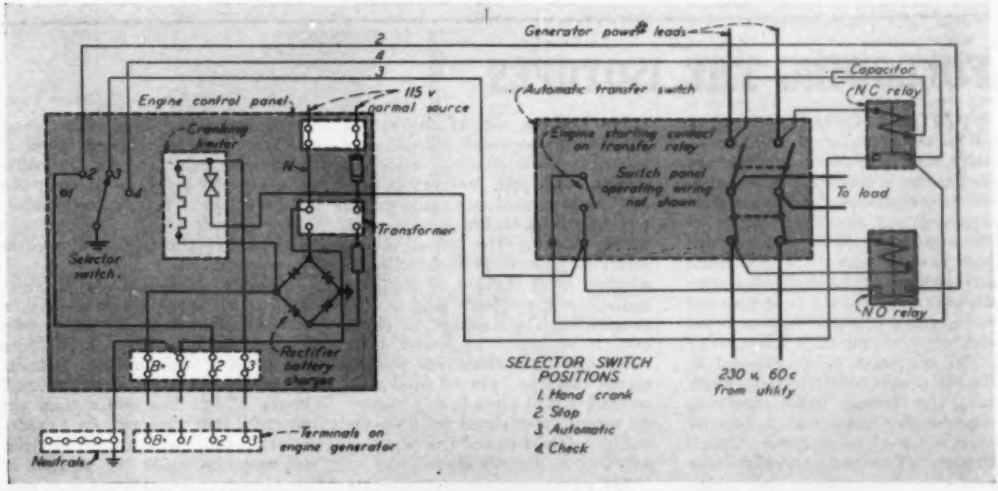


Fig. 3—Some controls supplied with engine are arranged for starting by grounding one terminal (No. 3, lower left). Grounding another (No. 2) stops engine. In this case, the transfer switch, center, which is the same as in Fig. 2, requires the auxiliary relays, right, with connections to the engine control panel, left, as shown in the diagram

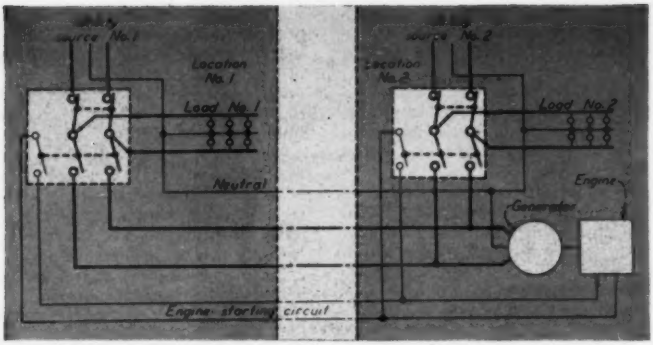


Fig. 4—Where two different loads, as in separated buildings, have individual sources, one standby generator may be used to supply emergency power to both by using the scheme shown. Either or both of the loads will be carried as necessary

fails, the coil of the transfer relay will become de-energized and the engine starting contact will close as before. If the selector switch is in position *3* (automatic), terminal *3* on the engine terminal board will be grounded and the engine will start. When the generator attains speed and voltage, the load will be transferred as described for Fig. 2. In addition, a normally closed (*NC*) relay, whose coil also is tuned to normal frequency by having a capacitor in series with it, will pick up. This will remove the ground from terminal 3, permitting subsequent shutdown by grounding terminal 2.

When the normal source restores, the load will automatically transfer back to it. Although the transfer relay opens the engine starting contact, the engine will not shut down with this starting method. However, the coil of the normally open (*NO*) relay will be energized from the normal source, and its contacts will close and ground terminal 2 to stop the engine. When the normal source fails, the *NO* relay will open, removing the *Stop* ground from the engine.

The engine control panel also contains a "cranking limiter" and a battery charger. The limiter is a thermal device which will open the connection to terminal *3*, after a definite period of automatic cranking, to avoid running down the battery. It may be either the "lock-out" type, or it may reclose after its thermal element cools, to permit another try at starting the engine.

The battery charger is a trickle type fed from the normal source. The low voltage battery generator on the engine will charge at a higher rate when the set is being used for emergency power.

The selector switch permits manual selection of various conditions. In position *1*, the engine may be turned over by hand, without starting, for adjustment purposes. If thrown from positions *3* or *4* to position *2*, the engine will stop. Position *4* permits starting for checking purposes, and position *3* is for automatic operation.

In a particular application, two separate buildings were fed by different utility sources. Continuity of service was desirable, and it was practicable to use one emergency engine driven generator as a standby for both buildings by the scheme shown in Fig. 4. The loads in both locations were small enough to permit the use of magnetically held transfer switches which would throw the loads on the emergency generator before it was started.

The engine starting contacts of the two automatic transfer switches were connected in parallel, and a three wire power circuit was run between the two buildings in addition to the two control wires. When either normal source failed, the engine would be started automatically, and the load fed by that particular source would then be carried by the generator. If the second normal source failed while the generator was running, its load would be instantly transferred to the generator. The engine would remain running until both sources were restored.

FOLLOWING THE ISOTOPES

WITH RADIOACTIVE materials becoming so readily available, it is inevitable that many new uses are being developed as a result of the exceptionally wide range of characteristics and penetrating power of the radiations. Wide publicity has been given to many of the applications and justly so. As a description reaches the right person at the right time and place, other uses are suggested and stubborn problems often solved.

Oil companies have pioneered in the use of many developments which have also become improvements in many smaller industries. Radioactive applications are no exception. Isotope Products Limited, responsible for numerous developments and equipment in the field, has provided some of the less widely publicized details on some applications.

For example, one of the earliest applications employed radium as a source for radiographing welds for defects. This year, however, iridium 192 has been used in Canada to test pipe line welds because it gives much better contrast. The isotope source, contained in a 30 lb lead trolley, is wheeled along the top of the pipe and clamped over each weld as it is completed. The exposure, about 1 min, is controlled by remote cable which moves the source into position against the pipe. (In an application on thick walled pipes in this country, the source is positioned inside at the end of a slender curved arm requiring only a ½ in. pipe tap in the wall.)

The isotope, antimony 124, is being used in this country in oil products pipe lines to mark the boundry between one product and another. A small amount is added when a new product is introduced and, when it reaches the receiving point, its radiation activates an alarm to warn the operator. In a further development, valve controls may be triggered and each product automatically directed to its proper route.

Another technique allows "pig chasing" in which the pig or go-devil, a rubber buffer that may carry wire brushes, is pushed through the pipe line by oil or water pressure. Radium, mounted on the go-devil, was first used in the Middle East where pipes are generally above ground. In Canada, however, the line is buried and the radiations by which the go-devil is traced must penetrate 4 to 5 ft of soil. Cobalt 60 has more recently been used to accurately time the progress and locate the go-devil if stuck.

HOW TO APPLY MECHANICAL DUST COLLECTORS TO SPREADER STOKERS

Many installations burning coal in suspension release large quantities of fly ash with the stack gases. This condition can be corrected by installing collectors to reduce stack discharge and minimize the loss of carbon

P. F. BEST, *Chief Mechanical Engineer, The Thermix Corp.*

SPREADER STOKERS are becoming more and more popular because they will burn almost any type of coal in varying degrees of purity and fineness. One great disadvantage of spreader stoker firing, however, is that, next to pulverized coal burners, spreader stokers by their very design tend to emit a great portion of the ash from the stack, a large part of which contains combustible carbon.

Although combustible carbon content in the fly ash can be lessened by utilizing adequate grate areas and thin fuel beds or by slowing down gas flow through the coal bed, the tendency today is to maintain high firing rates and to burn poor grades of coal. Both of these practices accentuate the dust problem. Coupled with this are the various municipal dust codes, which are becoming increasingly stringent.

Recently, dust collectors have been required for any type of coal firing, not only to conform with prevailing dust codes but also to gain in community good will. This situation has motivated attempts by manufacturers to meet the specific collection requirements presented by spreader stoker firing. Both stoker and dust collector manufacturers are conducting studies to help solve this fly ash problem, and cooperation between all parties concerned would be extremely desirable.

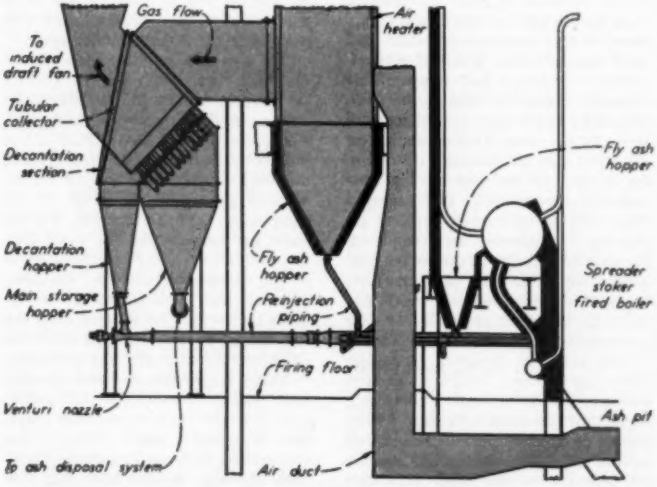
In order to envision an ideal dust collector for spreader stoker firing, the quantity of ash that might be expected to go up the stack should be considered. Naturally, this quantity is variable, depending upon many factors such as: (a) percentage of ash and combustible carbon in the coal, (b) grate area, (c) furnace volume, and (d) last but not least, whether partial or total ash reinjection is contemplated. Generally, from 20 to 50 per cent of the ash leaves the furnace in the flue gas, the exact percentage being determined by the burning rate. This ash will contain from 10 to 85 per cent combustible carbon. With reinjection, these quantities increase.

Dust particle size is an important consideration as numerous tests have shown that fly ash from spreader stokers will vary from 25 to 50 per cent minus 325 mesh. Although this same size range probably will hold whether or not there is reinjection, it is logical to assume the particles would be finer with reinjection. In this case, coarser particles tend to lodge on the grate and eventually go to the bottom of the fuel bed, while fine dust concentration in the gases gradually builds up. In addition, it may be assumed that the coarsest dust is generated when the firing rate is highest and the finest dust when the firing rate is lowest.

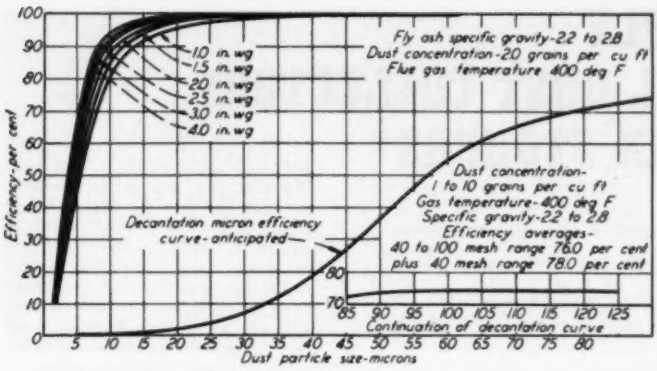
Combustible carbon content in the ash will influence equipment design. This factor is important to stoker manufacturers and still more important to ultimate consumers, since carbon content in the ash can run as high as 85 per cent. Assuming it runs 50 per cent, which is about average, there is still a vast amount of heat value to be gained by reclaiming the carbon.

Another consideration is the abrasiveness of spreader stoker ash, which is larger than pulverized coal ash and consequently has a higher terminal velocity, causing greater abrasion. Tests indicate the wear ratio of spreader stoker ash is 25 times greater than that of pulverized coal ash. This means that, with other conditions being equal, spreader stoker ash will wear out a metal surface 25 times as fast as pulverized coal ash. Also, because of its relatively low bulk density, spreader stoker ash requires larger storage facilities. Tests conducted at Battelle Memorial Institute show bulk density of this ash varies from 14.4 to 24.8 lb per cu ft as compared with 40 to 45 lb per cu ft for pulverized coal ash.

In presenting what actually has been accomplished in the development of dust collectors for spreader stokers, only the mechanical type will be discussed since probably 98 per cent of all spreader stoker fired boilers have

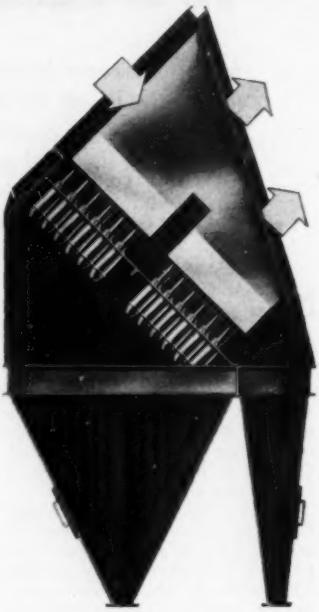


Drawing shows arrangement of collector for spreader stokers. Unit separates large high carbon particles for reinjection and collects fines for disposal


Fly ash specific gravity-2.2 to 2.8
Dust concentration-20 grains per cu ft
Flue gas temperature 400 deg F
1.0 in. wg
1.5 in. wg
2.0 in. wg
2.5 in. wg
3.0 in. wg
4.0 in. wg
Dust concentration-
1 to 10 grains per cu ft
Gas temperature-400 deg F
Specific gravity-2.2 to 2.8
Efficiency averages-
40 to 100 mesh range 76.0 per cent
plus 40 mesh range 78.0 per cent
Decantation micron efficiency
curve-anticipated
Continuation of decantation curve
Efficiency-per cent
Dust particle size-microns

Efficiency curve of dust collector for spreader stokers indicates anticipated performance when using ash reinjection

This photograph illustrates one method employed to segregate coarse particles and fine fly ash in the same collector



this type. Possibly electrostatic collectors, particularly in the larger sizes, will be used extensively in the future.

Unfortunately, all dust collectors operate on a percentage efficiency basis, although mechanical collectors provide fairly constant efficiency at all dust loads. Thus if a collector is operating at 95 per cent efficiency with an inlet dust concentration of 2 grains per cu ft, the amount of dust going up the stack would be 5 per cent of 2 grains or 0.1 grain per cu ft.

Many codes specify an allowable stack discharge dust concentration of 0.85 lb per 1000 lb of gas which is approximately equal to 0.25 grains per cu ft at 500 F. This can be a fairly severe limitation because where there is 20 per cent ash and total reinjection would give say 10.8 grains at the inlet, a collector with 97.7 per cent efficiency would be needed to cut down emission to legal requirements. Normally, such performance would not be expected even from the best collectors.

Many of the present codes acknowledge the severity of this restriction by incorporating an additional clause which requires either 0.85 lb of dust per 1000 lb of gas *or 85 per cent efficiency*. Such codes, of course, permit the use of equipment which could not be applied if the limitation on dust per pound were enforced. Obviously, there is an increasing need for collectors of higher efficiencies, particularly if the 0.85 lb of dust per 1000 lb of gas value is to be observed.

If and when the ideal mechanical dust collector is produced, it would:

1—Protect the operator against illegal dust emission regardless of operating conditions. This means the boiler could operate under any firing rate with any type of coal, with or without reinjection, and dust emission would be within code requirements.

2—Maintain high efficency, somewhere between 95 and 100 per cent.

3—Permit partial or total reinjection to recover all possible carbon.

4—Be of rugged construction to give long service despite abrasion.

5—Have adequate facilities to permit storage of say eight hours of operation, regardless of whether zero, partial or total reinjection is used.

6—Be low in initial cost, small in size, and easy to operate and maintain.

Many stokers reinject only from the boiler passes, while others are operated with total reinjection from a reasonably efficient dust collector. Some method short of total reinjection from a high efficiency collector is necessary, since this procedure increases dust loading as much as three times. Greater reinjection requires higher efficiency collectors to keep stack emission below a prescribed level. The more efficient a collector is, however, the more fine dust it collects, increasing dust concentration to the point where an infinitely more efficient collector becomes necessary.

In an attempt to effect ideal conditions, many companies install low draft loss collectors ahead of high efficiency collectors and reinject only material collected by the low draft loss collectors, which have an efficiency of about 60 per cent. This makes it possible to enjoy the benefits of returning at least 60 per cent of the unburned carbon, while still using a final collector of say 90 per cent efficiency to control stack emission. Such tandem arrangements are not prohibitive in initial cost, and operating expenses do not increase much because the low draft loss collector does not require any appreciable fan power.

Also available, however, is a high efficiency collector which substitutes a hopper for the back plate, permitting larger particles with high inertia to be carried to this hopper. Particles of smaller size having less carbon content are deflected to the high efficiency tubes for disposal. The efficiency of this device approximates 45 per cent on spreader stoker ash, analyzed at about 40 per cent less than 325 mesh and 15 per cent less than 10 microns in size. Although this efficiency is not as high as that of standard low draft loss collectors, it is accomplished with very little extra cost or floor space.

The cost of a collector for a spreader stoker installation will be governed more or less by the specific application. In the category of high efficiency, high draft loss collectors, one will cost about 11¢ per cfm, figured at 500 F with a draft loss of 2.5 in. wg and giving an efficiency of approximately 90 to 92 per cent. For the same gas temperature and draft loss, a collector with an efficiency of 95 to 97 per cent can be purchased for about 16¢ per cfm. These figures do not include the cost of the induced draft fan that would be required. Low draft loss collectors are naturally less expensive.

Many improvements have already been made in present day dust collectors to render them much more adaptable to spreader stoker firing. Close cooperation between manufacturers of both spreader stokers and dust collectors offers the greatest possibility for future advancement in the field.

PUMP MATERIALS THAT CAN REDUCE CORROSION

Selecting the proper material for pump parts is the first step towards reducing corrosion. This article brings out the characteristics of the various metals, and stresses the combinations applicable for special conditions that are met in the field

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Economy Pumps, Inc., Division C. H. Wheeler Mfg. Co.

COMBINATIONS of construction materials for the various parts of centrifugal pumps are many. The materials employed obviously depend on the economics and ultimate application. General service pumps such as double suction, end suction, and close coupled handling ordinary cold clear water, whether large or small, have materials that vary only slightly through the industry.

In this instance, the castings are cast iron. Small pumps operating at moderate pressures have low casing stresses as foundry practice calls for wall thickness greater than the stresses, even after allowing for corrosion. When pressures are higher, high strength irons and ribbing may be necessary. ASTM Specification A-278-49T refers to standard Classes of 20, 30, 40, 50, 60, and 70. Each class number is the ultimate strength of the particular iron, expressed in 1000 psi. Class 20 is seldom used but would be adequate for small low pressure pumps, while Class 30 is widely employed.

When high strength iron is needed, the pump manufacturer may suggest using low alloy irons such as Meehanite or Sorbomat, which are licensed process irons, or one developed by his foundry. Addition of 1½ per cent of nickel leads to a dense iron.

Ductile iron recently developed is becoming more widely available. The more favorable form of the free-graphite contained, as compared to unalloyed cast iron, is desirable to offset stresses. The more ductile character of this iron also favors applications where there will be shock.

From the users' standpoint, the method of attaining additional strength — whether by thickness of metal walls, by design and ribbing, or special alloy iron—is of little importance when the pump passes an adequate pressure test. The manufacturer will adopt the combination, which most economically serves the specified requirement.

Specific standard pumping units are ordinarily set up by the manufacturer for a definite maximum pressure, based on design and confirmed by tests. This design will be sold for any of a number of operating conditions inside the limit, because quantity production more than offsets the extra material. Sometimes a standard pump is so designed that substituting special materials will make it suitable for considerably increased pressures over the standard rating. In a case involving such an application, the recommendation will be made by manufacturer's engineers.

Operating pressure conformation has a bearing on the pump decision, along with other factors such as temperature, thermal shock, or pressure shock. Complete information concerning the service application must be presented to the manufacturer.

Usually steel is employed when the temperature exceeds 400 F, unless the iron parts are enclosed in a steel barrel. Steel may also be favored to avoid excessively heavy casings. Steel castings are often chosen for services involving either hydraulic or thermal shock. Impellers are of bronze for general service — usually 85-5-5-5, known as red brass or ounce metal.

Shaft Protection

Shafts are usually protected by shaft sleeves. When this is not the case, the shaft is made of corrosion resistant steel to prevent the packing from rusting to it. Carbon steel is adequate for the shaft when shaft sleeves are used, although various alloys are sometimes supplied as standard. A well designed pump can be expected to have a relatively large shaft for stiffness and consequently is not likely to be highly stressed. For this reason, high strength alloys are seldom needed.

Shaft sleeves are ordinarily made of bronze. A cast red brass or similar bronze has Brinnel hardness of only about 50 or 60, and a harder bronze will better resist wear by the packing. A Brinnel of 160-175 is very serviceable. Centrifugally cast sleeves are superior to static castings because they are denser and more uniform. The question of special shaft sleeve material is most apt to arise when the service indicates metallic packings.

Stainless steel shaft sleeves are quite often specified and usually are more expensive than bronze because of the longer machine time required for fabrication. An austenitic stainless steel such as "18-8" will sometimes develop a good hard surface, the hardening being obtained from the cold working effect of the packing. Generally speaking the stainless steels tend to be cut by metallic packing unless hardened. Type 416 (13 chromium) steel hardened to 500 Brinnel makes a very good sleeve. It has good corrosion resistance to many liquids besides having sufficient hardness to stand up with hard and tight packing.

Packing Combinations

Of course, stainless sleeves in the soft condition work out satisfactorily with soft asbestos packing when there is no need to tighten the gland a great deal. For example, a soap filled soft asbestos packing on a sleeve carbons at low pressure and temperature. On the other hand, the usual combination in such a case is carbon-asbestos or metallic packing on case hardened steel sleeves. This procedure is good for high pressure and temperatures of 350 F.

Case hardened steel sleeves are not corrosion resistant in the usual sense—though they are usually suitable where an *all iron* pump is used. They do have a good hardness, in the range of 400 Bhn and can be chrome plated to improve corrosion resistance.

Nitralloy shaft sleeves are most useful in the high temperature range beyond the field of general service pumps. Of course, the great hardness — around 900 Bhn — is always desirable, but it can be used for temperatures around 700 F, which would draw the case of a carburized sleeve.

Hard faced sleeves having surfaces of material such as Stellite and Colmonoy are likely to be somewhat costly for general service. They are built up by a series of welding operations and grinding. Such sleeves are widely used

in refineries because they are highly resistant to corrosion, will withstand the high temperatures, and at the same time have good hardness. K-Monel is another useful material for shaft sleeves. Of course, Monel is usable, but K-Monel is harder having Bhn about 280. This provides good corrosion resistance, depending, of course, on the liquid characteristics.

When special properties are required for chemical reasons, the choice may be made from Hastelloy, Inconel, nickel, silicon copper (Everdur), durimet, nitrided stainless, or other materials according to the special requirements.

Wearing rings are always provided to protect the casing except in very small pumps. These are preferable of bronze and would be of a different bronze than the impeller or impeller wearing rings to favor anti-friction characteristics should they rub. The exception is when dissimilar materials cannot be used because of electrolytic action to be expected.

Handling sea water with a general service pump that has been modified is a common application. In this service, there are many combinations of material in actual use with varying degrees of success. Choice of materials is influenced by cost and individual experience of users to a certain extent. In certain cases pumps have performed satisfactorily even though built of materials, which would not be considered likely to be serviceable. Sometimes, such a pump, after years of successful service, suddenly gives out.

Degree of pollution and nature of a contaminant will have an important bearing on the problem. The presence of hydrogen sulphide from sewage, for example, aggravates corrosion as does waste from refineries.

Choosing metals for sea water service is governed by the fact that sea water is an electrolyte. Dissimilar metals immersed in it produce a voltaic cell with resulting destructive effect on the less noble metal. Table 1 shows the galvanic series in sea water. This series differs somewhat from the emf series, but for the liquid under study it is a better guide.

An orthodox combination widely used in marine work is bronze casing and impeller usually Navy composition G or M, and Monel metal shaft. An all silicon copper pump (Everdur) is excellent also.

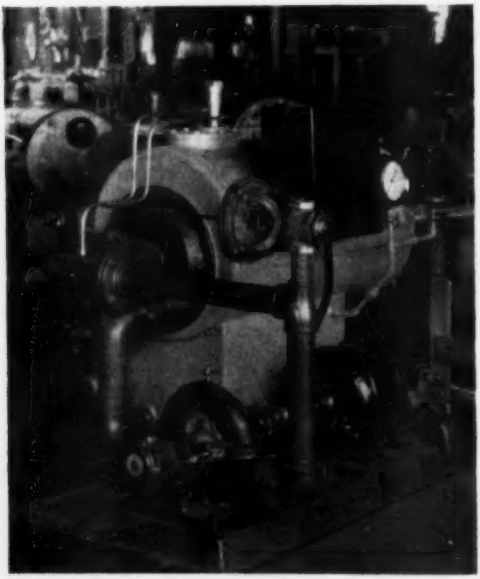
Bronze impellers, in an iron casing, tend to cause electrolytic destruction of the iron near the impeller by graphitization. This leaves what appears to be iron, but is only carbon and can be carved with a jackknife. The lowest first cost would lead to all iron construction, to avoid electrolysis, and this many times gives fairly good life. If the speed is relatively high or the water is contaminated, the selection would not be good for long life operation.

When electrolytic attack occurs to an iron casing, the action tends to protect the bronze impeller. However, when this has progressed to the point that the casing is extensively graphitized, the graphite acts cathodically to the impeller with the result that the impeller will corrode. This accounts for the reversal of experience on successive impellers in old pumps.

An all Ni-resist pump is much better than all iron and has given good results in sea waters of various sorts. A popular procedure is to add 1½ per cent nickel to iron for sea water service in order to produce better density metal.

When a part of the pump is expected to need further degree of protection it can be made of 28 chrome, 11 nickel stainless steel, or of stainless steel AISI type 316. There have been many highly successful installations of 28-11 where there was known contamination plus some cavitation. On the other hand 316 is also excellent.

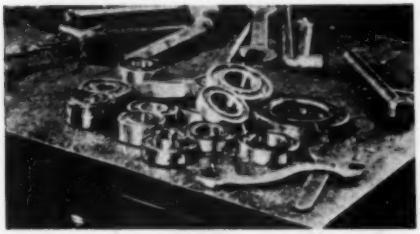
Another application of wide interest is that of pumping sodium chloride or calcium chloride brine. All iron is satisfactory for the latter, but the better material for sodium chloride is all bronze. Nevertheless, if there is any danger of ammonia leaking into the brine, bronze would suffer seriously in a very short time. All iron is the choice under these circumstances.



A further step to protect the pump is choosing metals that will not produce electrolysis when handling salts

TABLE I — GALVANIC SERIES IN SEA WATER

Magnesium	18-8 Stnls steel, type 304 (active)
Magnesium Alloys	18-8, 3% Mo stnls steel, type 316 (active)
Zinc	Lead
Galv steel or galv wrought iron	Tin
Aluminum 52SH	Muntz Metal
Aluminum 4S	Manganese bronze
Aluminum 3S	Naval brass
Aluminum 2S	
Aluminum 53S-T	Nickel (active)
Alclad	76% Ni-13.5% Cr-6% Fe (Inconel) (active)
	Yellow brass
Cadmium	Admiralty brass
	Aluminum bronze
	Red brass
Aluminum A17S-T	Copper
Aluminum 17S-T	Silicon bronze
Aluminum 24S-T	5% Zn-20% Ni, Bal. Cu (Ambrac)
	70% Cu-30% Ni
Mild steel	88% Cu-2% Zn-10% Sn (Composition G-brz)
Wrought Iron	88% Cu-3% Zn-4.5% Sn - 1.5% Pb. (Comp. M-bronze)
Ni-Resist	Nickel (passive)
	76% Ni-13.5% Cr-6% Fe (Inconel) (passive)
13% chromium stainless steel, type 416 (active)	70% Ni-30% Cu (Monel)
50-50 lead tin solder	18-8 stainless steel, type 304 (passive)
	18-8, 3% Mo stnls steel, type 316 (passive)



don't

work under the handicap of poor tools or a rough bench that is contaminated with dirt

do

work as close to ideal conditions pictured here. Dividends in bearing performance will be the result

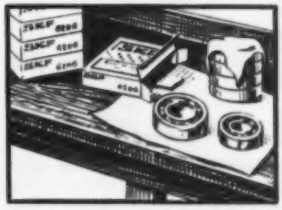
DO AND DON'TS FOR BEARINGS

JOSEPH L. BRUSCA,
Sr. Design Engineer
SKF Industries, Inc.

Don't work in dirty surroundings
Don't use wooden mallets or work on rough or dirty bench tops
Don't use dirty, brittle or chipped tools
Don't handle bearings with dirty, moist hands
Don't spin uncleaned bearings
Don't spin bearing with compressed air hoses
Don't use same container for cleaning and final rinsing of bearings
Don't use cotton waste or dirty cloths to wipe bearings
Don't scratch or nick bearing surfaces
Don't expose bearings to moisture or dirt at any time
Don't remove grease or oil from new bearings
Don't use incorrect kind or amount of lubricant

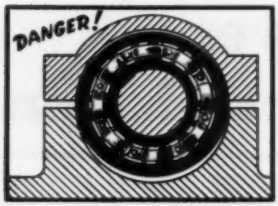
Do work with clean tools, in clean surroundings
Do remove all outside dirt from housing before exposing bearings
Do handle with clean, dry hands
Do treat a used bearing as carefully as a new one
Do use clean solvent and flushing oil
Do lay bearings out on clean paper
Do protect disassembled bearings from dirt and moisture
Do use clean, lint-free rags if bearings are wiped
Do keep bearings wrapped in oil-proof paper when not in use
Do clean inside of housing before replacing bearings
Do install new bearings as removed from packages, without washing
Do keep bearing lubricants clean when applying and cover containers when not in use

Proper care of bearings begins in the stock room where they are stored in their original unopened packages. The manufacturer protects the bearing with a grease coating, and an unopened package means continued protection. Bearing cartons should not be opened until ready to install bearing



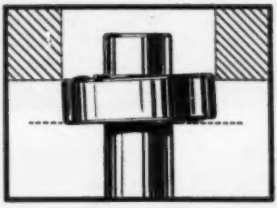
Open package only when ready to install bearing, and handle it with clean, dry hands and clean rags. Bearings should be laid on clean paper and covered to prevent exposure to a dirty bench or floor. Bearings should not be employed as a gage to check the housing bore or shaft fit

New bearings are packed clean and should not be washed prior to installing. Used bearings can be washed in clean gasoline or kerosene. The container must also be clean. After cleaning, it is thoroughly rinsed in light oil and relubricated. Bearings should be washed only when necessary

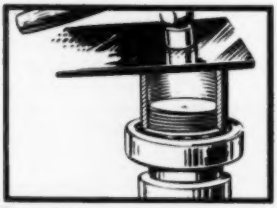


When mounting a bearing in a split housing check the housing bore for specified tolerances and roundness. Bearing must not be pinched by small bore or cocked race. Housing caps should not be interchanged. An undersized housing or out-of-round bore causes pinching and failure

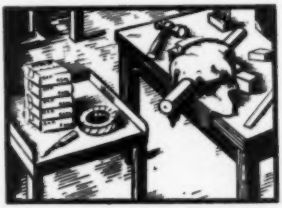
Shaft size should be checked for specified recommended tolerances before mounting bearing. The bearing seat should be perfectly round, not tapered and should be clean and free from nicks and burrs. During inspection the draft should be supported firmly and protected from the jaws of the vise that is holding the shaft in place



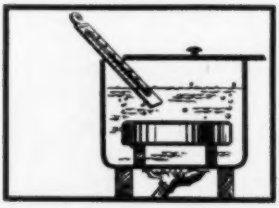
Precaution must be exercised when mounting a bearing in a solid housing. 1) The outer race should be perfectly square with the housing bore before any pressure is applied. 2) The housing bore should be checked for the specified tolerances. 3) Housing bore and bearing outside diameter should be coated with light oil or micronized graphite



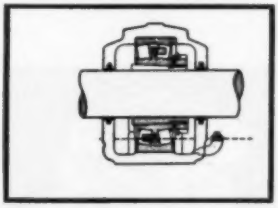
To press fit the bearing, place a clean pipe over the shaft that rests on the inner race. Before pressing, coat the seat, shaft and bore with light oil or micronized graphite. After checking the bearing for squareness, pressure is applied by tapping the end of the pipe with a hammer or arbor press



When the assembly job is unfinished the bearing should be covered if for only a few hours or until the next day. Rewrap each bearing with grease-proof paper to keep out dirt and moisture, when necessary. Improper handling of the bearing during installation will greatly reduce its life



Expanding the bearing for shrink fit can be done in either of two ways: 1) Place in clean 200 F oil for about 15 min. The bearing must be supported to isolate it from the bottom of the container, contact will cause overheating. 2) Heating in a temperature-controlled oven to a maximum of 200 F for about 15 min. Tighten the lock nut immediately after the bearing reaches the shaft shoulder. When not properly locked the bearing may move away from the shaft shoulder



Type of lubrication oil usually depends upon the operating conditions, and the machine manufacturer's instructions must be followed. When oil is employed about half of the bottom ball or roller is covered. A sight gage is preferred marked so as to show static and operating oil levels. Such usage will greatly help to determine when additional oil is required. The operating level varies and can be determined only when the bearing and machine are operating

For Best Results From ELECTRONIC TUBES

FRANK CHARITY, *Consulting Engineer*

Operating conditions are often more sharply limited for electronic than for other types of equipment. It is worthwhile to design suitable conditions into the plant services whenever possible, and to combine with them an engineered maintenance program. Where plantwide voltage regulation and cooling systems, and elaborate test facilities such as used at Consolidated Vultee Aircraft Corp. and illustrated in photo at right, are not feasible, local provisions and maintenance procedures will help insure best operation

TUBES ARE VITAL elements in the electronic circuits that are now so essential to the operation of much of the modern industrial equipment. They may have, for practical purposes, almost unlimited life. But not if specifications are exceeded.

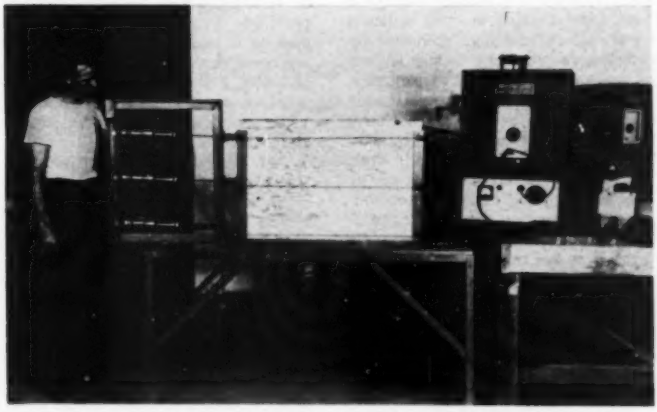
That is why they are guaranteed to operate for only 1000 hr by the average tube manufacturer. A tube with no integral defects can withstand very severe usage for a certain amount of time, but he cannot be responsible for tubes that fail due to often unrecognized but extreme conditions.

As replacement parts, electronic tubes are not generally expensive. Yet a tube failure can be quite costly in terms of rejections and lost production time. For example, it has been estimated that Douglas Aircraft Company is now saving more than $5000 monthly due to the recent adoption of maintenance methods that have reduced tube failures by a margin of only 10 per cent in the use of resistance welding equipment.

Further, it should be noted that there have been (and may again be) circumstances in which electronic tubes could not be replaced at any price because of nationwide shortages of certain critical materials like tungsten.

First step in avoiding failures is to make sure each new tube is in good operating condition. Manufacturers make every effort to maintain high quality standards, and there is no reason to believe that any of their products are defective at the time of shipment. But many things can happen to an electronic tube before it reaches a consumer.

Most damage due to rough handling can be detected simply by checking condition of the carton in which it was received and looking for loose or broken parts. Special test instruments may be used to ascertain presence or absence of less obvious defects. But in shops



Although resistance welding is one of the largest applications of industrial electronic tubes, many others are expanding rapidly. The dielectric heater above is used in the manufacture of plywood panels. Cooling and protective equipment should receive regular inspection

Electronic test and inspection equipment of all types is becoming common, requiring more attention to voltage regulation, cooling systems and maintenance programs to provide maximum tube life and reliability. Equipment shown is used at Boeing Airplane Company

which cannot afford such instruments, maintenance personnel can be reasonably certain that a new tube is in good condition if it can be used in place of an identical tube, which is known to function properly, without altering the performance of an electronic circuit. Preferably, the socket used in making the latter test should be heavily loaded.

There is no reliable method of estimating or predicting the ultimate lifespan of a tube in any electronic circuit, due to slight structural variations that cannot be detected in finished tubes. However, it has been proved that life is directly proportional to:

(1) Filament voltage.
(2) Plate voltage.
(3) Residual gasses.
(4) Fatigue of metal parts.
(5) Heating and cooling cycles.
(6) Efficiency of cooling system.
(7) Efficiency of associated relays.

Virtually all types of modern industrial equipment with electronic accessories may have features designed to prevent the abuse of electronic tubes. These usually provide for the limitation of initial surge current when filament voltage is first applied, application of filament and other voltages in sequence, automatic self-regulation of filament voltage settings, removal of supply voltages whenever plate or grid current exceeds the allowable maximum, and disconnection of supply voltage whenever plate cooling becomes inadequate.

However, even if it could be safely assumed that each welding unit, for example, in current operation has all of the latter features, it should be remembered that automatic protective devices themselves are not infallible.

In the operation of recently developed dielectric heaters and three phase welding machines, for instance, filament voltage is automatically controlled (within a 1 per cent tolerance) by constant voltage transformer. However, if voltage settings and readings are not checked occasionally to assure the proper functioning of the filament transformers, there is an excellent possibility that tubes will eventually be damaged or ruined.

Incidentally, filament or heater voltage is regarded by many experts as the most important factor in tube life. Among other things, they assert, a majority of tube failures in older types of resistance welding equipment have been the direct result of too high filament voltage—a condition that could have been avoided in most instances by frequently checking voltmeter indications and adjusting voltage settings as necessary for optimum performance.

Most tubes can be satisfactorily operated with 5 or 10 per cent lower filament voltage than indicated by manufacturers' technical data; and, when this is done, the life of a tube can be doubled or tripled because lower voltage means less heat for the cathode or filament. All cathodes will eventually deteriorate, but this can be delayed indefinitely if they are not heated more than absolutely necessary. Voltages exceeding manufacturers' recommendations by more than 5 per cent will invariably shorten the life—sometimes causing a tube to fail instantly.

Note, however, that reduced cathode potential implies good voltage regulation either on the supply lines or by regulators incorporated in the control equipment. Excessive voltage variation, coupled with lower settings, may allow cathode voltage to drop below the satisfactory minimum value.

Hot cathode mercury vapor tubes, when installed for the first time or when used after a long period in storage, should be operated at rated filament voltage for at least 15 min before plate voltage is applied in order to redistribute mercury which may be deposited on active elements of the tube. Otherwise, a 2 min (check manufacturers' specifications) warmup period should be sufficient unless the tube has been removed from the socket. If the tube appears to be unstable, after proper warmup, arcing can often be eliminated by temporarily operating the tube with lower plate voltage.

Anode cooling is especially important in operation of high vacuum ocillator and rectifier tubes with high power ratings. Where provisions are made for cooling the anodes with a forced flow of water or air, the system circulating the coolant should allow daily inspection to make sure it is functioning properly. Most air and water cooled tubes have thermostatic controls designed to prevent the flow of plate and filament current if cooling is inadequate, but operation of thermostats can often be impaired by small particles of dirt or scale.

Where tap water is used, scale formations in the circulating system must be anticipated and cleaning schedules provided. Presence of excessive formations is usually heralded by a hissing noise, due to the localized boiling of water, and scale should be eliminated as soon thereafter as possible.

No scale should occur where tubes are cooled with air or distilled water in an enclosed circulating system. However, a clean, cool atmosphere is highly advisable. Otherwise, tubes and related circuit elements, unless adequately protected as by dust-tight enclosures and filtered air, should be carefully cleaned every week or two to eliminate dust and other foreign matter. Accumulations may cause intermittent electrical contacts and localized heating effects. Clean, dry compressed air or a vacuum line can be used to remove foreign matter from relatively inaccessible areas. Larger and more accessible surfaces, such as the glass bulbs of vacuum tubes, should be carefully polished with a clean rag.

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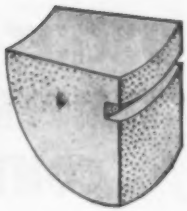

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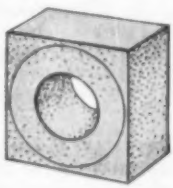

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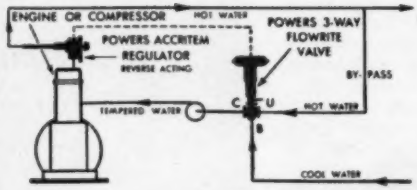
JACKET WATER TEMPERATURE CONTROL

Investigate



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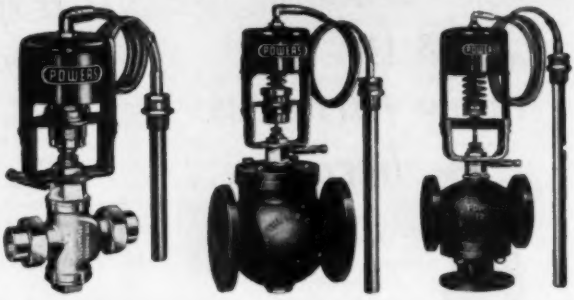

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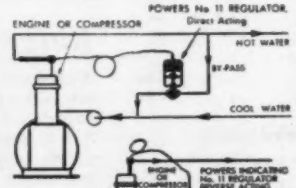

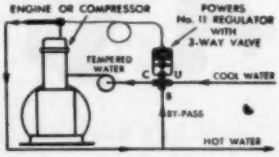

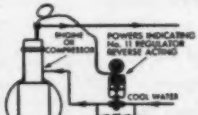

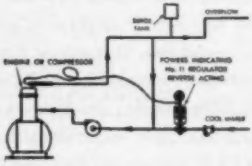

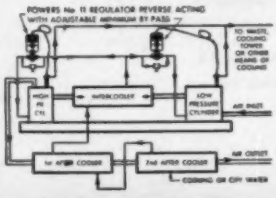
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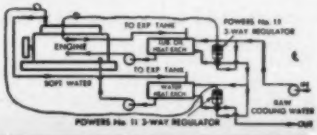
AIR INLET
AIR OUTLET
2nd AFTER COOLER
COOLING OR CITY WATER



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THERMOCOUPLES, TEMPERATURES AND ATMOSPHERES

W.C. LONGSTRETH, *Brown Instruments Div. Minneapolis-Honeywell Regulator Company*

RELIABILITY of the results that can be expected from a pyrometer depend very largely on the selection of the proper thermocouple for the application. Not only must the couple be properly constructed from carefully selected materials, but the type and wire sizes must be correct for the temperature ranges and the conditions under which the thermocouple is to be used.

Many combinations of metals have been used as thermocouples. In fact, almost any two dissimilar metals will produce some thermoelectric effects. While a considerable number of combinations are used for special purposes, the thermocouples listed in the table, lower right, are most generally used in industry, and have been found to be most satisfactory for practically all applications.

If the thermocouple ordered is a replacement for one in an existing installation, it must be made of the same materials for which the instrument is calibrated. The type of couple to be used with the instrument is ordinarily marked on the chart or scale. In ordering a replacement, the purchaser should be certain that the new couple has the same temperature-emf equivalents as those for which the instrument was calibrated. With certain types of thermocouples, various manufacturers may use equivalents differing slightly from each other, and use with an instrument calibrated to other equivalents may cause several degrees error.

Thermocouple Combinations

For a new installation, the thermocouple material and the size of wire depend on the temperature to be measured, the atmosphere in which it is to be used, and certain other considerations. The characteristics of the generally used types listed are as follows:

Copper-constantan. The temperature range over which they are ordinarily used is —300 to +600 F. Over the range of —300 to +300 F, their accuracy is the highest of any type of couple. They are very resistant to rust and corrosion, and readings are reproducible to a high degree of precision. Used largely in laboratory work and pilot plant operation, they are available only in the smaller wire sizes, number 20 B & S gage being about the largest.

Iron-constantan. These thermocouples are ordinarily used for temperatures from 300 to 1400 F, in atmospheres deficient in free oxygen. For iron-constantan couples, an oxygen content above ½ per cent is considered to produce an oxidizing atmosphere; less than ½ per cent, a reducing atmosphere. Above 1000 F, oxidation of the iron wire increases rapidly, and 8 gage wire should be used for temperatures from 1000 to 1400 F. This wire size is good for temperatures up to 1600 F under reducing conditions, especially if proper protecting tubes are employed. Under special conditions, it may be used up to 1800 F, but life of the couple is likely to be short, and accuracy uncertain at all times.

The iron-constantan couple produces the greatest emf per degree of temperature among standard types.

Chromel-Alumel®. This type is particularly useful for measuring temperatures from 1000 to 2000 F in atmospheres containing free oxygen. A complete absence of free oxygen has a tendency to alter the thermoelectric characteristics. An atmosphere having more than 2 per cent is considered oxidizing and one containing less is reducing when this combination is used. When the atmosphere is alternately oxidizing and reducing, the upper temperature limit should be reduced about 50 F.

Platinum-platinum rhodium. These couples, with suitable protecting tubes, are usable up to 2900 F in oxidizing atmospheres, and to 2700 F in reducing atmospheres. When hydrogen is present, it penetrates practically any thermocouple protection and tends to alter the temperature-emf relationship. The rate at which the loss of accuracy takes place depends on operating temperature, and amount of hydrogen which enters and remains in the tube. Vented protecting tubes will help to alleviate this condition, and secondary protecting tubes are recommended at temperatures above 2200 F.

In any type of couple, wire size is important. With small wires, sensitivity is increased. Larger sizes, however, will result in longer life, and will make possible continued use at higher temperatures.

Length of the couple must be sufficient to permit insertion of the measuring, or hot, junction far enough into the process to give a true reading of temperature. Insufficient immersion causes low readings, due to the conduction of heat along the wires away from the measuring junction. In general, the couple should project a minimum distance inside the furnace wall equal to four times the outside diameter of the protecting tube or well. If

PRINCIPAL THERMOCOUPLE TYPES AND PROTECTING TUBES

Thermocouple wire combinations
- Copper-constantan
- Iron-constantan
- Chromel-Alumel®
- Platinum-platinum rhodium

Primary protecting tubes—metal
- Steel
- Wrought iron
- Cast iron
- 28% chrome iron
- Chromel T
- Inconel

Primary protecting tubes—ceramic
- Vycor
- Sillimanite

Secondary protecting tubes
- Steel, coated steel, iron
- Firebrick
- Millite
- Silicon carbide

the couple must pass through the walls of a muffle furnace or through a water-cooled furnace wall, projection should be approximately ten times the tube diameter.

The couple should extend a sufficient distance outside the furnace wall so that the thermocouple head will not exceed 250 F in temperature.

The graph illustrates recommended conditions of temperature and atmosphere for various thermocouples.

Primary Protecting Tubes

While maximum sensitivity is obtained with a thermocouple without a protecting tube, practically all couples for industrial measurement require protection against corrosion or mechanical injury. Tubes for this purpose may be of metallic or ceramic materials. The most commonly used metal tube materials are discussed in approximate order of their resistance to increasing temperatures. Chromel-Alumel* couples should be used unless alternates are indicated:

Steel. These tubes are seamless, made from low carbon steel, and are suitable for use in non-corrosive liquids and gases up to 1000 F. At this temperature, 14 gage iron-constantan couples should be satisfactory. Steel tubes, however, can be supplied for use with 8 gage iron-constantan.

Wrought iron is usable in atmospheres containing less than ½ per cent oxygen, at temperatures up to 1300 F. Where greater amounts of oxygen are present, temperatures should not exceed 1200 F. In non-corrosive atmospheres, wrought iron can be used at higher temperatures if frequent replacement is not objectionable. They can be supplied with iron-constantan couples also when desirable.

Cast iron tubes are cast in one piece from an alloy iron, produced by the electric furnace process which improves grain structure and general physical properties. They are more resistant to corrosion than wrought iron, and may be used up to 1600 F in atmospheres containing less than ½ per cent oxygen. Where greater amounts of oxygen are present, temperatures should be limited to 1300 F. This material is suitable with iron-constanan couples.

Resisteat, or 28 per cent chrome iron. The tube can be of seamless drawn material, or drilled from solid bar stock. It is more resistant to corrosion and sulphur than other chrome-iron alloys. Maximum temperature is 1800 F, although the tube may sag at 1500 F if mounted horizontally.

Chromel T is a chrome-nickel alloy, widely used for general purpose tubes. It is more resistant to oxidation than materials with lower nickel-chromium contents. It is equally satisfactory for use in oxidizing or reducing atmospheres at temperatures up to 2000 F, and can be used at higher temperatures where the atmospheres are highly reducing or sulphurous.

Inconel is also a chrome-nickel alloy but with a high nickel content. It can be used in oxidizing or reducing atmospheres at temperatures up to 2100 F. It offers high resistance to cracking under rapid temperature changes, and shows no tendency to become brittle after long exposure to intermediate temperatures.

Ceramic Primary Tubes

Ceramic materials are being used increasingly for thermocouple protecting tubes. Their rapid speed of response, ability to withstand high temperatures, and low initial cost make them desirable in many applications. Among the most widely used materials are the following:

Vycor. This is a glass which has exceptional stability, high speed of response, low thermal expansion, and high softening point. Radiant heat penetrates vycor much as the sun's rays penetrate glass. It has high resistance to thermal shock. It makes an excellent tube material for 8 gage couples and for oxidizing or reducing atmospheres up to 1800 F. When used above 1600 F, the tube should be installed vertically to avoid sagging.

Sillimanite is a fine grain, unglazed refractory, far superior to other porcelains in performance under servere conditions. It has excellent mechanical strength, resistance to gas penetration, and resistance to thermal shock. Tubes with ⅛ in. wall thickness can be heated safely at rates of temperature rise up to 750 F per minute.

Sillimanite tubes may be used with platinum-platinum rhodium couples in oxidizing or reducing atmospheres up to 3000 F. If installed horizontally, without support, tubes will sag at temperatures above 2800 F. Secondary protecting tubes are recommended when sillimanite is used at temperatures higher than 2200 F.

Secondary Protecting Tubes

Secondary protecting tubes are recommended to increase the useful life of thermocouples and primary tubes under severe conditions of chemical attack, thermal and mechanical shock, and high temperature. Their use, however, increases the over-all time lag, and may introduce complications in automatic control installations.

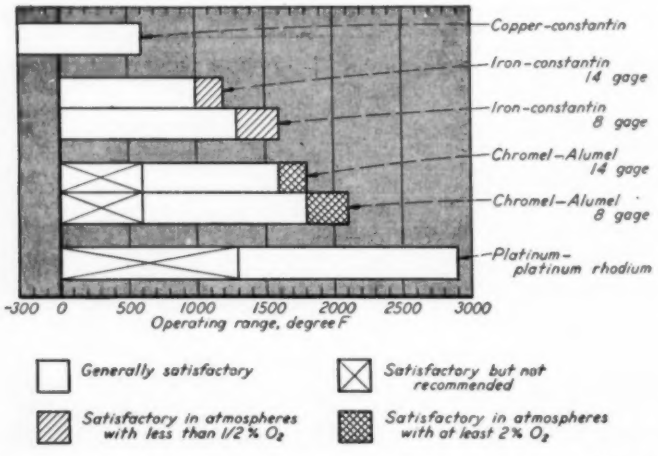
Among the satisfactory materials for secondary protecting tubes are the following:

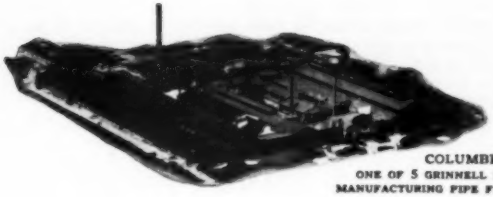
Metals. Seamless steel, wrought iron and metal coated steel secondary protecting tubes are available for use in galvanizing tanks and other non-ferrous metal baths. Their characteristics are given under the heading of primary protecting tubes.

Firebrick tubes are made of high grade refractory clay. They are used principally as secondary protection for porcelain or sillimanite tubes for temperatures up to 2650 F.

Mullite. This material has the same characteristics as sillimanite, listed under ceramic primary protecting tubes.

Durax (silicon carbide). This material has high abrasion resistance, exceptional strength at high temperatures, and very good thermal conductivity. It is used for secondary protection in temperatures up to 3000 F where uneven heating, rapid temperature changes, and mechanical shock are to be expected.





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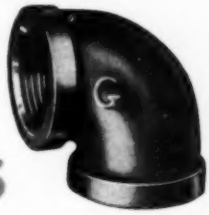

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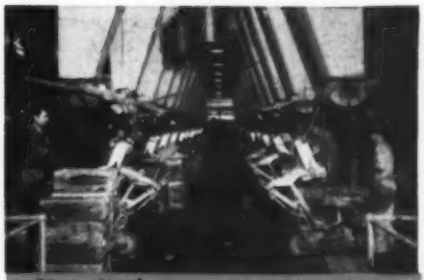

Dimensional accuracy assured by finest equipment and modern methods of mechanized molding.

Smooth inside finish obtained by the use of the best core sand and the employment of superior core making equipment.

Superior metal, poured into molds on continuous conveyors, gives Grinnell pipe fittings extra strength . . . extra ruggedness.

Accurate chamfer and precision threads, produced by modern tapping machines, provide easy starting and tight joints.

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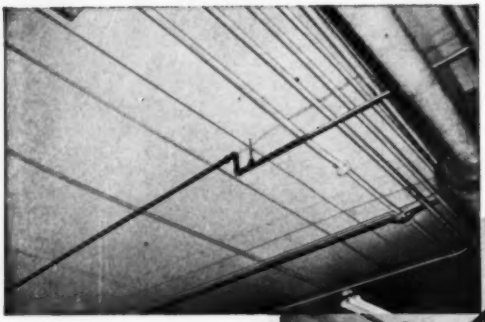
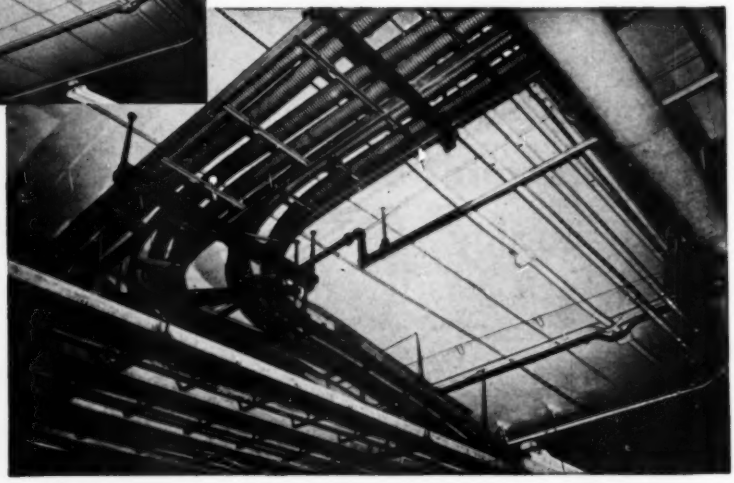


GETTING DISTRIBUTION IN FAST was the big problem in the conversion of a Midwest warehouse to a defense plant. Here the ceiling was available for wiring, but a decision had to be made on the type of wiring that would go in fast and offer the most practical results.



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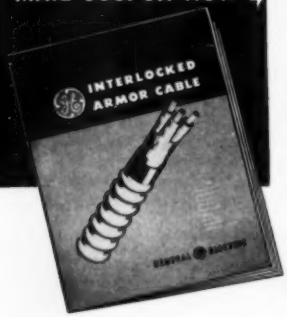

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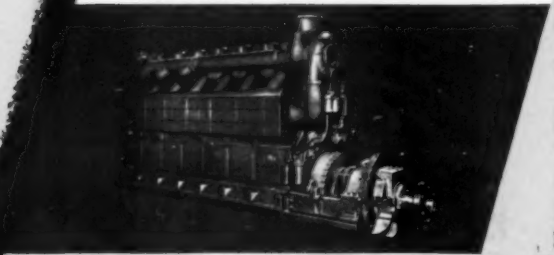
with the NORDBERG *Supair Thermal* Engine

Above: Three 8-cylinder Nordberg FS-138-HSC, *SUPAIR-THERMAL* 1000 kw, 450 rpm generating units at N. V. Overzeese Gas En Electriciteit Maatschappij, an electric utility in Aruba, N. W. I.



Above: Nordberg 6-cylinder FMD-136-HSC, *SUPAIRTHERMAL* engine developing 800 bhp at 300 rpm, for direct drive—direct reversing—propulsion of tugboat owned by Foss Launch and Tug Company, Tacoma, Wash.

NOW, with the Nordberg *SUPAIR-THERMAL* Engine,* you can actually get twice the horsepower output over an ordinary normally-aspirated engine of the same bore, stroke and speed . . . without any increase in floor or overhead space. Thus, you can pack twice the power in a limited plant space, or in an engine room on board ship.

In addition to doubling the horsepower in the same space, the *SUPAIRTHERMAL Engine* produces *more horsepower hours per unit of fuel and lube oil . . . with lower installation cost. Maintenance cost per horsepower generated is also lower.*

Here, then, is the outstanding engine in the entire Diesel field . . . available for all power applications, in a full range of 4-cycle types for fuel oil, Duafuel, or spark ignition gas operation—in sizes from 535 hp upward. *For full details on the SUPAIR-THERMAL Engine write for BULLETIN 191.*

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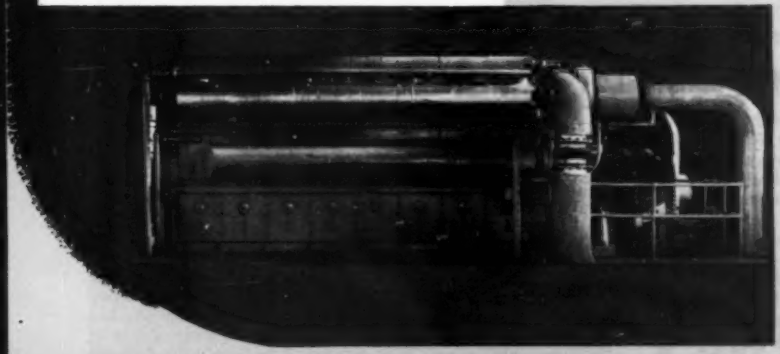

Left: Nordberg 8-cylinder FS-148-HSC *SUPAIRTHERMAL* engine developing 2100 horsepower at the Fernandina, Florida, plant of the Florida Public Utilities Company.

NORDBERG MFG. CO.
Milwaukee, Wisconsin

P-SM182

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NORDBERG
DIESEL ENGINES

Spot news

Short, "boiled-down" paragraphs on the most interesting recent events and developments in American industrial plants

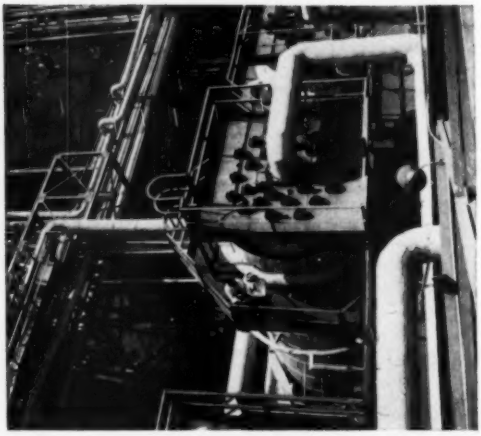
Sun Oil Uses Catalysts To Make Heat From Wastes

Last spring a waste burning catalyst attracted national attention by running a Pennsylvania plant on its own smells. The process is now reported to have been successfully applied in the oil refining industry. A partial installation in a petroleum cracking unit at Sun Oil Company's Marcus Hook refinery is saving more than enough money to pay for itself. Waste carbon monoxide and hydrocarbons, blown out of petroleum cracking reactors in a continuous stream, are burned as they pass through the catalyst. Full utilization of the process at Sun's Marcus Hook and Toledo refineries is expected to achieve total savings of $500,000 annually.

Consisting basically of catalytic alumina and platinum alloy, the new catalyst was developed by E. J. Houdry, creator of the Houdry process for catalytic cracking of petroleum—applied for the first time in large scale operation at Marcus Hook in 1937.

Oxidation catalysts are not new at Marcus Hook. As early as 1937 catalytic reactors were built onto the cracking units. They consisted of cases, 25 ft high and 127 in. in diameter, which were loaded with one of Houdry's early oxidizing catalysts, basically copper oxide. Life of the catalyst was short and maintenance costs were excessive, however, so the units were taken out of service several years later—pending development of a better catalyst. One of these units has been adapted for use of the new catalyst.

Instead of occupying the entire case as the pellets did, the new catalytic units occupy only the top 15 in. Measuring 5½ in. long, the units are made up of two porcelain end plates which are 3 in. square, a porcelain spacer bar and 73 porcelain rods coated with a .003 in. film of catalytic agent. Gases flow across the rods, which are tear-drop in cross-section for minimum flow resistance. Free space for gas flow is approximately one half total cross-section. Combustion occurs at the surface of the rods. In this installation, a grid support was installed on top of the existing cooling elements and the catalytic units were stacked on the grid in layers of 500 each. It took only three men on each of two shifts to complete the installation and put the system in operation.



Oxidation reactors at Marcus Hook. The unit shown in foreground contains new waste burning catalytic elements

This unit has now been operating four months and has produced an average of 7,500,000 Btu per hr. Flue gas enters at 775 F and average temperature after leaving the catalytic units reaches 1075 F. Molten salt, circulating through finned tubes, cools the gas to about 825 F. The salt then passes to a salt boiler, a part of the cracking unit, where about 80 per cent of the total heat liberated is converted to high pressure steam. The balance of the heat increases temperature of flue gas to a gas turbine, resulting in additional production of about 80 kw.

Yearly return of the operation, based on fuel value alone, is estimated at $27,500. Since existing equipment was used, the only investment was the cost of the catalyst—approximately $25,000. Replacement cost is $7500, however to date there has been no measurable loss of activity in the catalysts.

More representative of costs is a proposed moving bed installation for a large eastern refinery. Estimated cost of this installation is $107,000, which includes the boiler unit, catalyst chamber, piping, catalyst elements and all erection. Heat recovery is estimated at 20,600,000 Btu per hr—the equivalent of about $120,000 of steam annually.

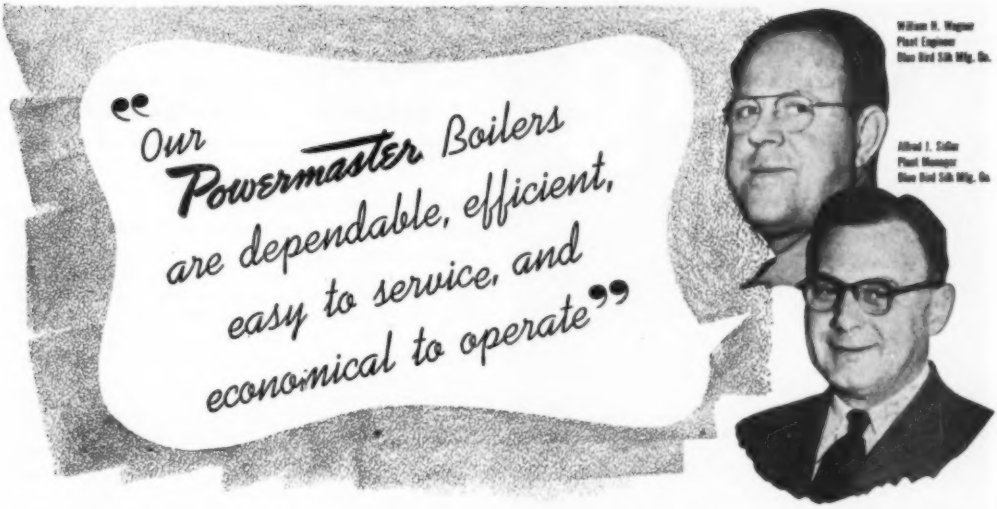
(Continued on page 112)

The Cover - Water Horsepower

This month's cover shows one of the hydro-electric power stations of the Shawinigan Water and Power Company's $100,000,000 expansion program in Quebec, Canada. This unit, designated as the Trenche development, has a generating capacity of 325,000 hp.

The dam contains 550,000 cu yd of concrete and measures 1500 ft from bank to bank. The main section is 225 ft from the ground and 25 ft across at the top. It is one of six units located on the St. Maurice River at the present time. Four additional units are scheduled, and the total generating horsepower will be 2,500,000.

Acknowledgment is made to the American Crosby Clipper, published by American Hoist and Derrick Co., for these data and cover illustration.


"Our Powermaster Boilers are dependable, efficient, easy to service, and economical to operate"
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Alfred J. Sidler
Plant Manager
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20% Saving in Steam Cost at York, Pa. Manufacturing Plant

William H. Wagner, Plant Engineer of the Blue Bird Silk Manufacturing Company, knows the problems of generating high-pressure steam 24 hours a day, 365 days a year. And he knows how serious it can be for a busy manufacturing plant if there is trouble or failure in the boiler room. That's why, two years ago, the company replaced their old-fashioned coal-fired boilers with two 200 h.p. POWERMASTER packaged automatic boilers, burning #6 (Bunker C) oil. Here is what they found:

- The cost of producing steam for processing and heating dropped 20%.
- The steam produced now is much dryer.
- The POWERMASTERS respond very rapidly to variations in load.
- Maintenance has been negligible.

Little wonder that Alfred J. Sidler, Plant Manager, says, "If we had it to do over again, we would certainly buy POWERMASTERS."

No other packaged automatic boiler gives you *all 3 advantages of the Powermaster:*

1. SAVE FUEL.—because the special *Powermaster* burner design gives you top efficiency when operating anywhere between 30% and 100% of capacity.
2. SAVE IN MAINTENANCE and clean-up time. Complete combustion of fuel gives practically smokeless and carbon-free operation. The burner has *no* moving parts to wear out . . . or to be cleaned daily.
3. CHANGE FROM OIL TO GAS (or gas to oil) in just a few minutes. Burn light oil, heavy oil, or gas—whichever is cheaper. You no longer need depend on one source of fuel supply.

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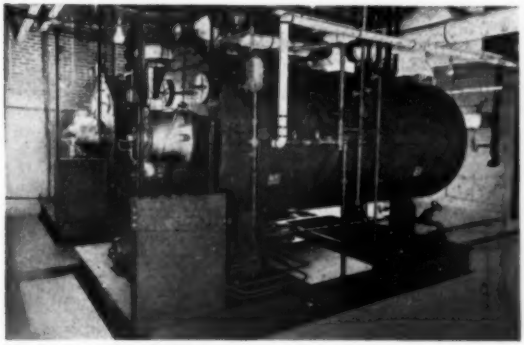
To get complete information about this modern packaged automatic boiler for steam or hot water, write for *Powermaster* Bulletin 1218. We'll be glad to put a copy in the mail for you.



These 200 h.p. POWERMASTER packaged automatic boilers have been operating round-the-clock for more than two years at the Blue Bird Silk Manufacturing Company, York, Pa. Burning #6 oil, they produce a total of 13,800 pounds of steam per hour.

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In sizes to 500 h.p.; pressures to 250 psi.

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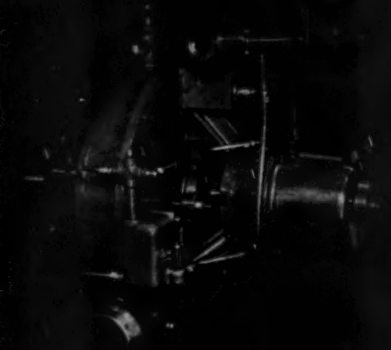

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	Standard	High Pressure
MAXIMUM BHP	100	150
MAX. STEAM TEMP.	525° F	750° F
MAX. PRESSURE	275 lbs.	600 lbs.
BACK PRESSURE up to	50 lbs.	50 lbs.
SPEEDS up to	4000 RPM	4000 RPM

SPECIFICATIONS

ROTOR: All Steel
BUCKETS: Nickel Steel
NOZZLES: Bronze, Stainless Steel or Monel depending upon Steam Conditions
PULLEY DRIVE: Separate Jackshaft Coupled to Turbine
LUBRICATION: Filtered Oil or Grease
GOVERNORS: Overspeed Trip & Speed Regulating
STUFFING BOXES: Split removable, packed with semi-metallic packing
BEARING CAPS: Bearings are mounted in separate housings attached to main castings
VERTICAL SHAFTS: Available in all sizes
ROTATION: Clockwise or counter-clockwise

L. J. Wing Mfg. Co.
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Spot news

(Continued from page 110)

Exhibit Demonstrates Value of Silicones as New Engineering Materials

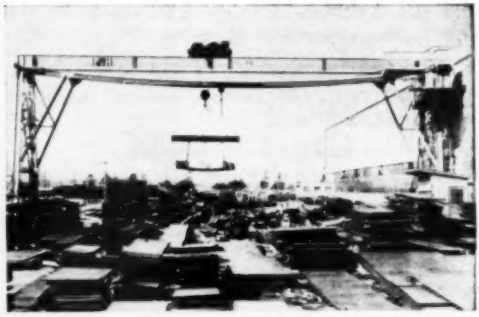
Developed to show the remarkable properties of the silicones and their usefulness as new engineering materials, the Dow Corning Silicone Exposition has resumed its tour of showings in leading industrial areas. Over 17,000 executives and engineers saw this display last year. Slanted at a technical and engineering level, the exposition is not open to the general public.

Several new demonstrations have been added to the ten tons of equipment which make up the display. Demonstrations, ranging from kettles of boiling oil to 15,000 v arc testers, put silicone products through their paces, while actual product assemblies, sections, cutaways and parts show their practical value on the job.

Laboratory men and representatives are on the floor at all times to explain details and answer technical questions. Among the cities to be visited in November and December are Newark, New Haven, Baltimore and Winston-Salem.

Diesel-Electric Crane Is Built To Meet Unusual Requirements

Unusual demands of power application faced engineers of the Harnischfeger Corp. in the design of a gantry crane for a northern Michigan plant. Equipment with towering booms, manufactured at this plant, had to be able to move freely around one section of the yard. The usual overhead



power source was therefore ruled out for safety reasons. In addition, the location posed icing problems. Underground power lines were not wanted because of their high initial cost and difficult maintenance.

Solution to the problems caused by these demands was found to be a built-in power source. Mounted on the crane sill, and fully enclosed, is a 50 kw d-c generator driven by an 80 hp, 4 cylinder diesel engine. Power for all crane operations is supplied by this source. Controls for the diesel engine are located in the operator's cab. The crane has a 60 ft span with a 15 ton capacity and 3 ton auxiliary.

(Continued on page 114)

Is there a pump doctor in the house?

YES... THERE'S A BJ PUMP SPECIALIST A FEW MILES OR MINUTES FROM YOU!

If you have a sick pump—or if you're having trouble diagnosing a pumping problem, a BJ pump specialist can help. These fully-qualified BJ Sales Engineers, working out of 31 *company* sales offices, bring you the benefit of BJ's 80 years' experience in meeting and solving every kind of pumping problem. These local Byron Jackson offices are in addition to BJ's six modern factories, six service shops, and reliable dealers. For pump engineering assistance and quick answers to your particular pumping problems, just phone your nearby BJ Branch Sales Office!

Byron Jackson pump manufacturing plants are located in Los Angeles and Fresno, Calif.; Houston and Plainview, Tex.; Lawrenceburg, Ind.; and Bethlehem, Penn.

In addition, BJ Service Shops are operated in Chicago Heights, Ill.; Chico and Lodi, Calif.; Casa Grande and Phoenix, Ariz., and Lubbock, Tex.

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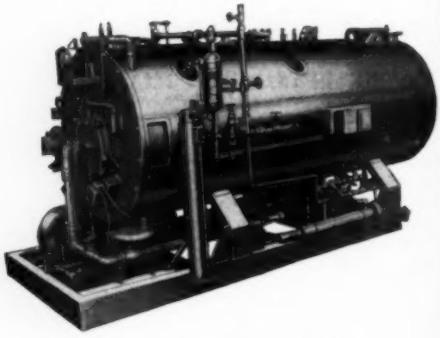

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15# to 200# w.p.
OIL or GAS

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Builders of Better Boilers Since 1848

Spot news

(Continued from page 112)

Utility Installs Second Gas Turbine Unit for Power Generation

Oklahoma Gas and Electric Co. has reported 23,000 hr of operation without service repairs for a General Electric gas turbine installed in their Belle Isle generating station. When installed three years ago, this unit was the first gas turbine to be commercially used in the United States for electric power generation. Although rated capacity is 3500 kw, the average load for the three year period has been over 4400 kw, or more than 120 per cent of rating.

Commercial operation of a second unit, also manufactured by General Electric Co., began this summer. Although essentially a duplicate of the first, improvements in design and manufacture have made possible a rated capacity of 4000 kw. It is expected that under favorable conditions the new machine will deliver up to 5000 kw.

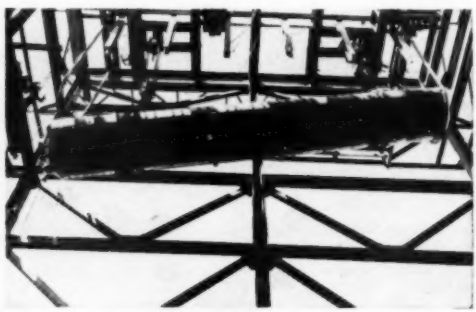
In addition to the gas turbines, the station has two larger steam turbine generators with a total capacity of 50,000 kw. Exhaust of the two gas turbines is used to heat boiler feedwater, so that in addition to their actual power production, the gas turbines can be credited with boosting output of the steam units by 4500 kw, or nearly 10 per cent.

Dual-Fuel Engine Takes Over Bulk Of Small Municipal Plant's Load

Operation of a small municipal electric plant involves many special problems. Although production volume is low, such major operating costs as labor are equal to that of much larger plants. Johnson, Kansas, with a population of 900, is a typical example.

In building a municipal plant, in 1938, the city assumed that initial investment must be kept as low as possible.

(Continued on page 118)

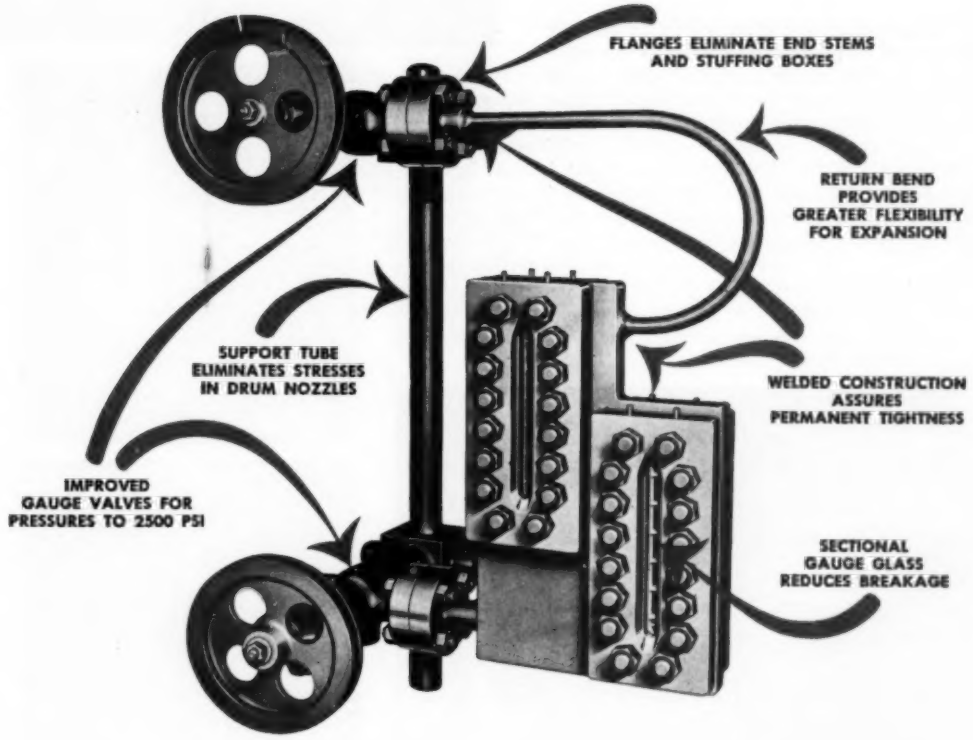


INSTALLING 120 TON DRUM AT JOPPA

About to be landed is a 50 ft long, 70 in. OD drum for one of six Combustion Engineering-Superheater steam generators being installed at the Joppa Steam Station of Electric Energy, Inc., Joppa, Ill. Each unit will have a maximum continuous rating of 1,200,000 lb per hr of primary steam at 1925 psig and 1055 F, and 1,110,000 lb per hr of reheat steam at 489 psig and 1005 F

New DIAMOND Flange Connected WATER GAUGES

More Suitable to High Pressure Operation


FLANGES ELIMINATE END STEMS AND STUFFING BOXES
RETURN BEND PROVIDES GREATER FLEXIBILITY FOR EXPANSION
SUPPORT TUBE ELIMINATES STRESSES IN DRUM NOZZLES
WELDED CONSTRUCTION ASSURES PERMANENT TIGHTNESS
IMPROVED GAUGE VALVES FOR PRESSURES TO 2500 PSI
SECTIONAL GAUGE GLASS REDUCES BREAKAGE

In addition to the advantages shown above, this gauge provides maximum level visibility with minimum drum nozzle spacing. Greater reading accuracy is another important feature. The bend (which is uninsulated) provides sufficient condensing area to assure active circulation of hot condensate through the gauge. This maintains the gauge at higher temperature so there is less difference between boiler water and gauge water density. That and the shorter gauge assure greater accuracy.

Write for new Bulletin No. 1051X describing Diamond Water Gauges and Water Columns.

DIAMOND POWER SPECIALTY CORPORATION

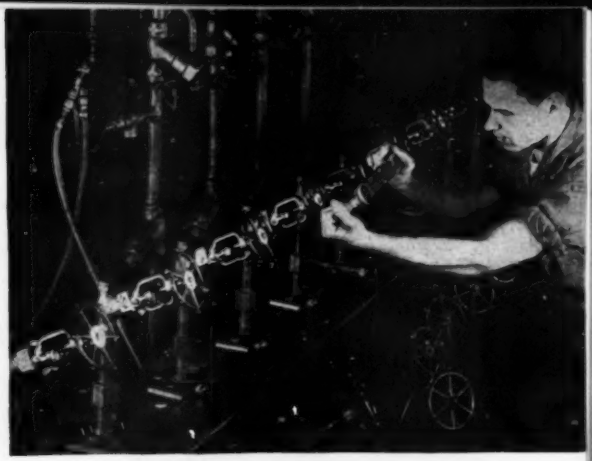
LANCASTER, OHIO

Diamond Specialty Limited—Windsor, Ontario

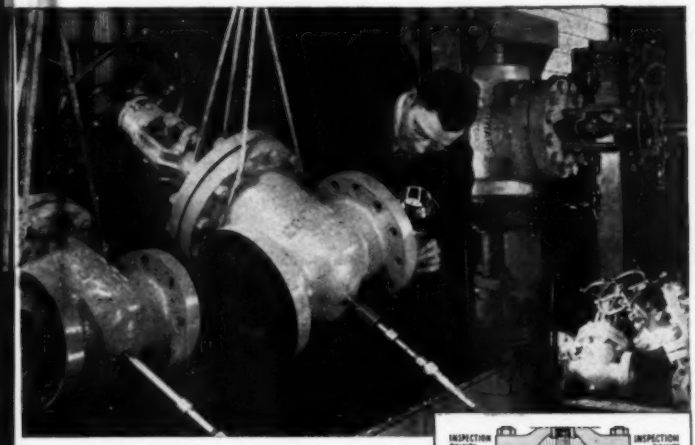
4840

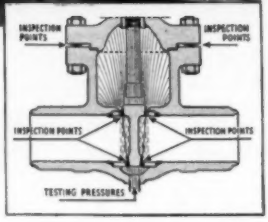
valve values
PHOTO NEWS

No Exceptions- *Every* *Edward Valve* MULTIPLE TESTED



Building components accurately doesn't necessarily insure assembled product performance. Valve tightness, for example, can be established only through rugged testing. And one test isn't enough. Tightness dependability is guaranteed only by multiple testing of every valve—each test designed to prove performance under service operating conditions. For example, the 14-in. PRESSURE-SEAL globe valve (right) designed for operation at 900 psi underwent three separate hydrostatic tests for soundness of pressure containing parts and tightness of bonnet joint and backseat. The Fig. 444 globe valves above, designed for 600 lb, were subjected to a 26 step test procedure including hydrostatic pressure of 3000 psi before receiving an O.K. for shipping release. Every Edward valve from tiny ⅛ in. gage valves to largest 2500 lb design must fully meet test requirements. There are no exceptions or tolerances in Edward testing standards.





Many test procedures are exclusive with Edward. Special method of testing gate valve illustrated uses pressure injected through bottom of body to surround seat faces, yet leaves both ends open for inspection. *Both* sides of gate valve wedge must be tight simultaneously to pass test.

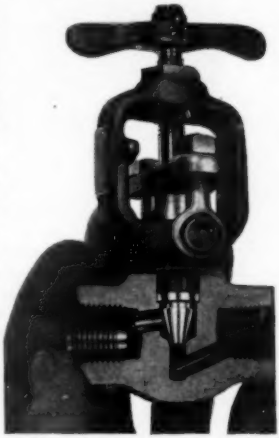
No guesstimating in Edward test procedures. Every test condition is controlled by precision tools and instruments. In applying load to handwheels for seat joint testing, torque wrenches are used to precisely measure allowable test torques—only 70 inch-lb to hold 6000 psi for the Fig. 952 valves pictured. Valves must be drop tight at this load to pass test.

Edward Valves, Inc. Another Product

NEW Forged Instrument Valves

FOR HIGHER TEMPERATURES AND PRESSURES

Modern instruments and controls, operating at high temperatures and pressures, require a large cash investment. Sound operating practice demands that these costly devices be protected by small stop valves designed for use at the temperatures and pressures of the fluid being measured or controlled.



Until recently there was no really satisfactory valve for this service. Small threaded bonnet valves were unsatisfactory for high temperature-pressure applications, but were often used because of the lack of a suitable bonnetless valve. Standard globe valves, satisfactory from an operating standpoint, were too bulky for crowded locations such as instrument panels.

For these services, Edward developed its Fig. 952 series instrument valves. Rated for pressures up to 6000 lb at 100 F or for 1500 lb at 1000 F, these all drop-forged steel O. S. & Y. valves completely answer the need for a high pressure, high temperature instrument valve. They are ideal for installations where space is at a premium.

It is impossible to manually damage these ruggedly constructed little valves. Yoke, gland and gland bolts are drop-forged steel for added strength. Drop-forged body eliminates the possibility of pipe seams often found in barstock construction, or internal voids prevalent in thin-walled castings. The vital body-yoke threaded connection, consisting of an external thread on body and internal thread on yoke, is completely outside of pressure area within valve.

FOR EASY PACKING

Simply remove nuts on the two swing gland bolts and position gland on yoke gland rests. Repack valves, as illustrated, with complete freedom of both hands. Generous space between stem and yoke allows quick, trouble-free repacking.

Stem of hardened EValloy, 13% chromium stainless steel, is centerless ground for smooth packing contact. Tapered, needle point disk integral with stem, plus fine pitch stem thread, allow accurate flow adjustment.

Valves are furnished in ¼", ⅜", and ½" sizes in either globe or angle types. Fig. 952-3 valves have carbon steel bodies, while Fig. 2952-3 are furnished with bodies of EValloy, 13% chromium stainless steel. (AISI Type 416 weldable.) Fig. 2952 valves are also furnished in ¾" and 1" sizes. Screwed or socket welding ends are provided.

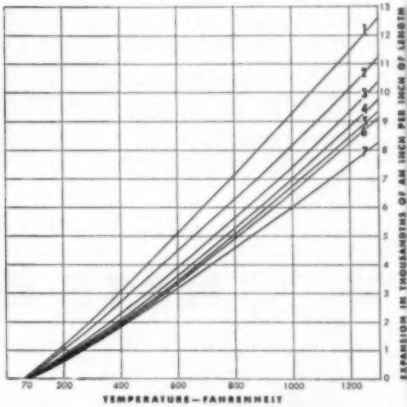
EDWARD VALVES, Inc., *Subsidiary of*
ROCKWELL MANUFACTURING COMPANY
40 WEST 144th St. EAST CHICAGO, INDIANA

GLOBE AND ANGLE STOP • FEED-LINE • BLOW-OFF • NON-RETURN CHECK • GATE • GAGE AND INSTRUMENT • RELIEF • STRAINERS

Technical Tips

What Thermal Expansion Does to Valve Materials

Coefficients of thermal expansion greatly influence the selection of modern valve materials. For example, if the thermal expansion coefficient of a valve stem is greater than that of the valve body, a valve closed tight at an elevated temperature might be less tight as it cooled off, often resulting in leakage. If, on the other hand, the thermal expansion rate of the stem material is substantially less than that of the body material, the stem will contract less than the valve body on cooling, with the result that it may not be possible to open the valve with ease. Ideally, stem material should have a coefficient of thermal expansion only 10 to 20% less than that of the body and bonnet material.



COEFFICIENT OF THERMAL EXPANSION AT TEMPERATURE OF VARIOUS VALVE MATERIALS

1. **18% Chromium—8% Nickel Stainless Steel valve trim material.**
2. **Monel—Valve trim material.**
3. **Stellite No. 6—Valve trim material.**
4. **A.S.T.M. A216—WCB—Carbon Steel body material.**
5. **A.S.T.M. A217—WC6—1% Chromium Steel body material.**
6. **A.S.T.M. A217—WC9—2½% Chromium Steel body material.**
7. **Edward EValloy—13% Chromium valve trim material.**

The chart shows the coefficient of thermal expansion of several valve trim and body materials at temperatures up to 1300 F. Obviously, Edward EValloy meets the ideal thermal requirements for stem materials mentioned above. This, plus its many other desirable properties, make it the most widely used valve stem material.

Hard surfacing is an effective method of imparting resistance to abrasion, galling and corrosion to vital parts of valves. However, cracking may occur if the thermal expansion of the deposited metal and the base metal are different. The chart shows that the coefficient of thermal expansion of Stellite No. 6 is very similar to that of the low alloy valve steels on which it is deposited. This, plus its "red" hardness and resistance to abrasion and corrosion at elevated temperatures makes it an excellent hard surfacing material for valves.

Edward

Spot news

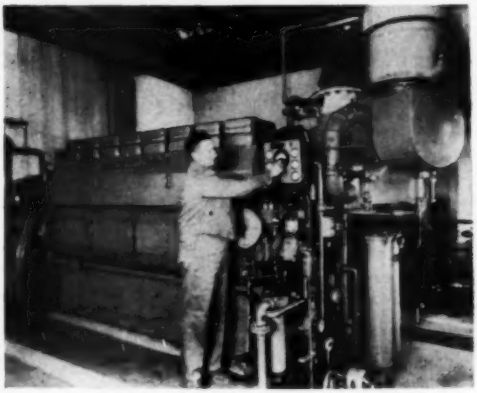
(Continued from page 114)

Original equipment included two 100 hp, 1200 rpm gas engines, each driving a 60 kw generator. In 1946 a 150 hp, 300 rpm diesel was installed. Then in 1948 the original units were replaced by two gas engines rated 160 hp at 1200 rpm. A 35 year old diesel also was installed for standby insurance.

With these prime movers, power was produced for an average fuel-lube cost of approximately 9 mill per kwh. Inflationary pressure pushed total operating costs up, however, and profits began to turn into deficits. Modern equipment, which would offer greater operating economy, was decided to be the best solution.

In June of 1950 a heavy duty Duafuel engine, manufactured by Nordberg Manufacturing Co., was installed. This 4 cycle turbocharged unit has 8 cylinders of 9 in. bore and 11½ in. stroke, and develops 530 hp at 600 rpm. Natural gas is used for fuel with a small quantity of pilot oil for ignition. The unit drives a 350 kw generator built by General Electric Co.

Immediately the new engine took over the largest portion of the load. In the first 12 months it ran 5996 hr and produced 656,200 kwh, approximately 70 per cent of total plant load. Although load for the period was only about 30 per cent of the engine's capacity, total fuel costs were calculated to be 5.4 mills per kwh. Load at this plant has been steadily increasing. With increased load, greater fuel economies are expected. The plant is again operating with a profit.

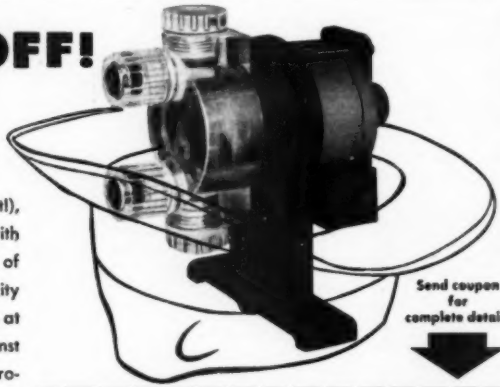


To insure continued efficient operation, the city has provided modern accessory equipment to serve the new engine. Some of this equipment can be seen in the illustration. The plant superintendent is shown checking exhaust temperature with an Alnor pyrometer. Also shown is an Elliott turbocharger, Air-Maze air filter, U. S. Hoffman and Purolator lube filters, Nugent fuel filter and Blackmer auxiliary lube pump.

(Continued on page 120)

HATS OFF!

...TO THIS LITTLE PROPORTIONING PUMP



Send coupon for complete details

Despite its small size (it would fit in your hat!), %Proportioneers% MICRO-SHOT is loaded with big advantages for the proportionate pumping of chemical solutions. This is a low cost, low capacity metering pump designed for delivering liquids at controlled rates up to 2 gallons per hour against pressures to 50 pounds per square inch. Micro-Shot is furnished as a complete "Package", including an electric or hydraulic control mechanism together with the necessary tools and instructions for installation, operation, and maintenance.

Micro-Shot is ideal for dependably feeding all the more common corrosive chemical solutions at very low rates. The "See-Thru" pumping head is of thermoplastic resin, permitting observation of diaphragm and valves while the pump is working. A calibrated indicator permits ready selection of feed rate while pump is in operation.

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Please send Bulletin 1923 describing %Proportioneers% Micro-Shot.

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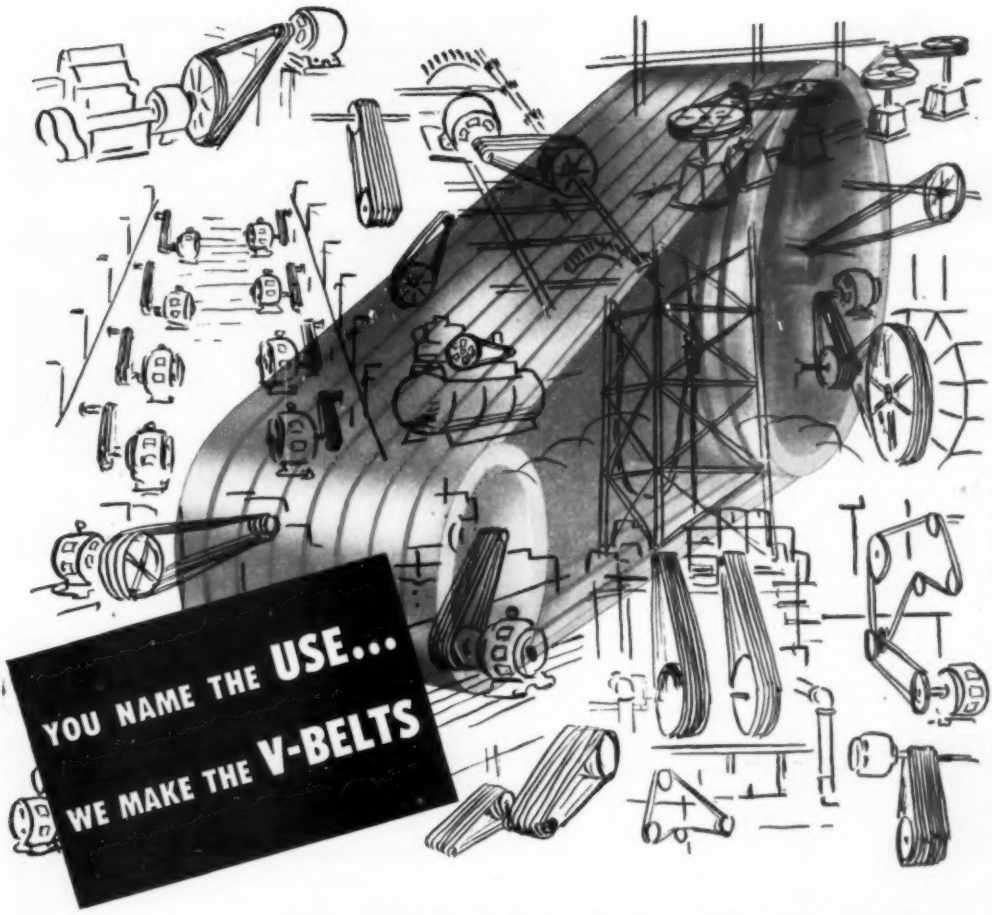
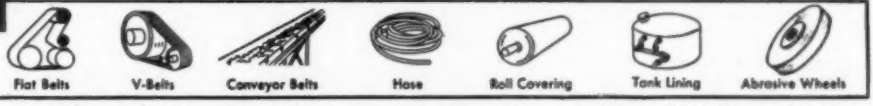


Condor V-Belts can save you money on any type of Multiple Belt drive . . . for any use . . . in any industry. They are the smoothest running V-belts made because every part of the construction is *precision-balanced*. Straight sidewalls provide more grip, less slip, longer life. They are made also in special oil, heat, and static-resisting constructions • V-Belts may not be your problem today but whenever you think of hose, of conveyor, transmission, V-belts, or industrial rubber products for *any* use — remember "Raybestos-Manhattan makes it". Consult your R/M representative.

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.



Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Packings • Brake Linings • Brake Blocks Clutch Facings • Asbestos Textiles • Sintered Metal Parts • Bowling Balls

Spot news

(Continued from page 118)

First Sand Dryer Without Moving Parts Is Installed in Buffalo Plant

Featured in a foundry sand reclamation system recently installed at the Buffalo plant of Worthington Corp., is a vertical sand dryer having no moving parts. Maintenance problems, which normally result from the many moving parts used in previous types of dryers, are therefore eliminated. To date, only one other installation is known to use a similar dryer—that being an installation at the Rosenlew Co. in Finland.

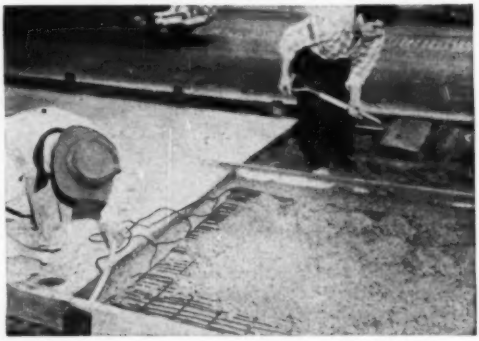
Manufactured by Hydro-Blast Corp., the new system will reclaim up to 5 ton of used foundry sand per hour. In operation, sand washed from foundry castings is passed through a revolving cylindrical screen which breaks up lumps and removes foreign objects. It is then mixed with water and pumped as a slurry into a 6 unit classifier which removes silt. Coming out of the classifier, it is passed through a special cylinder for removal of excessive water.

Thus washed and ready for drying, the sand is elevated to the top of the drying tower. It falls naturally through the tower, passing slowly through a series of hot air ducts. By the time it reaches bottom, the sand is clean and dry. Conveyers then transport it to a storage bin above the mixer. The entire system works on automatic controls. Power is supplied by 13 electric motors ranging from 1 to 15 hp.

New Laboratory Uses Electric Cable Embedded in Concrete for Snow Removal

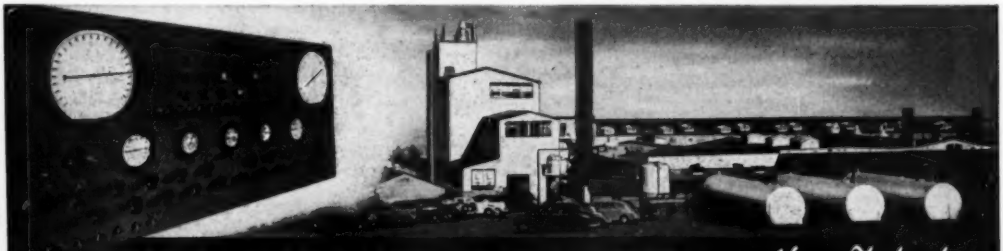
One of the largest snow melting installations using electric heating cable embedded in concrete was recently completed at the new John T. Ryan Memorial Laboratory of Mine Safety Appliances Co., Pittsburgh.

Seventy-two standard Thermwire sets of 800 w each, manufactured by Edwin L. Wiegand Co., were embedded in



1440 sq ft of sidewalk. With an installed capacity of 57.6 kw, a heat intensity of 40 w per sq ft is obtained—sufficient to melt the heaviest expected snowfalls as fast as the

(Continued on page 122)



PUSH BUTTON PLANT OF THE FUTURE . . . *Here Today!*

The Ehret Magnesia Manufacturing Company's new plant at Valley Forge, Pennsylvania, is truly a "push button" plant. Insulation block and pipe covering are fabricated to precise dimensions by remote control. All operations are automatic, thus greatly reducing costs and at the same time improving the uniformity and quality of the product.

A unified contract made it possible to start design and construction simultaneously, thus saving many months over the time normally required to place the completed plant in operation.

This is the type of construction and engineering service that you, too, can depend upon from The Kuljian Corporation where undivided responsibility prevails on a project from the very beginning until production starts.

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ENGINEERS • CONSTRUCTORS

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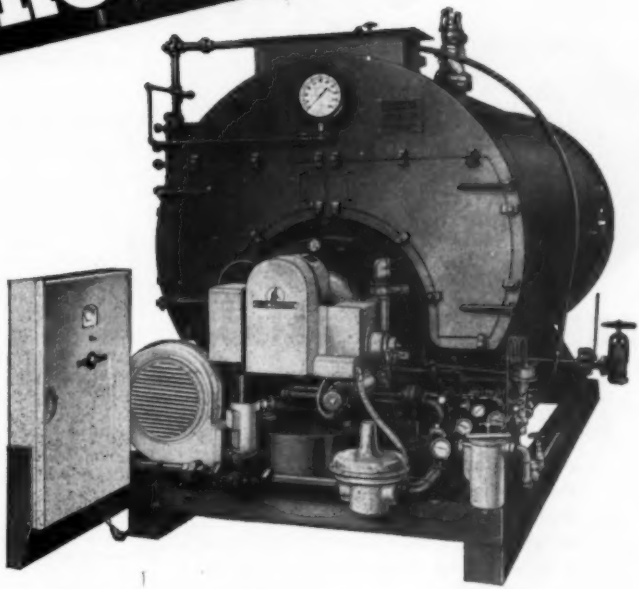
KEWANEE and IRON FIREMAN

- *For oil, for gas, or oil and gas firing*
- *For every commercial and industrial application*



Jointly announce a NEW boiler-burner UNIT

Two outstanding companies in their respective fields—Iron Fireman and Kewanee—have combined their engineering talents and their long experience in designing and producing this unique new boiler-burner unit.

Every part has been skillfully engineered for balanced operation to give users what they want; efficient utilization of fuels, with resulting low-cost steam; and fully automatic, dependable performance.

The burner, including all controls, built-in forced draft fan and oil pre-heating system, is completely assembled, wired, tested and shipped to the installation site from Iron Fireman. The boiler, completely assembled with all of its essential elements, is shipped from Kewanee. Matching connections are provided for quick, easy installation.

Available for high pressure steam in sizes with outputs ranging from 52 to 456 h.p., 125 and 150 lb. working pressure, and also from 5470 EDR 15 lb. steam or 30 lb. water. These units may be automatically fired with No. 6 or lighter fuel oils, gas (either high pressure or as low as 2 oz.) or a combination of both fuels.

Send for this 14-page catalog

This catalog, produced in full color, gives COMPLETE information on all sizes and models, including *detailed specifications.*

Use coupon or write

MAIL to KEWANEE or IRON FIREMAN

Name_____

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IRON FIREMAN MFG. CO.
3123 West 106 Street, Cleveland 11, Ohio

KEWANEE-ROSS CORPORATION
115 Franklin Street, Kewanee, Illinois

The modern way to reface handhole seats . . . ELLIOTT

HANDHOLE SEAT GRINDER

This is one of those accessories that saves its cost many times over in a short period. Corroded or marred handhole seats can be a headache, as after inspections you're never sure the covers are tight until the pressure is on again. And if they are not tight, it takes hours of expert and laborious hand filing to make them so.

The easy answer is the Elliott Handhole Seat Grinder, which refaces seats on a fixed plane clean and true with positive accuracy, and assures that a boiler put back on the line will stay there, with no need for correcting handhole leaks.

Available with electric motor and pistol grip as shown above, or with air-driven motor. Drives are interchangeable. Full details in Bulletin Y-22, on request.

Y2-7

ELLIOTT Company

LAGONDA DIVISION • SPRINGFIELD, OHIO

Plants at: Jeannette, Pa. • Ridgway, Pa. • Ampere, N. J. Springfield, O. • Newark, N. J.

DISTRICT OFFICES IN PRINCIPAL CITIES

Spot news

(Continued from page 120)

snow comes down. The cable employs an abrasion resistant covering which will not react with free lime in concrete.

Installation was made at the site. Standard cable lengths were fastened to commercial mesh with hog-ring staples. After an initial pouring, the mesh was placed and covered with the top inch of concrete. Before this was smoothed, leads were strung through conduit to junction boxes under the lawn. Operating cost, based on an average Pittsburgh winter, is estimated at about $50 per year.

Atomic Research Facility Established on Long Island

Walter Kidde Nuclear Laboratories, the first privately financed research organization devoted primarily to development of atomic power for commercial and industrial purposes, has announced that new laboratory facilities on Long Island will be ready for occupancy about Nov. 1. Research operations will start on that date, although the installation of certain specialized equipment will continue for several months.

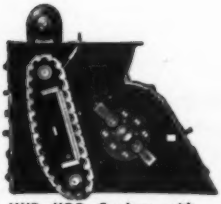
Areas are devoted to chemistry, physics, metallurgy, radiochemistry and materials testing. Also housed in the new structure, which will serve as headquarters for the firm's operations, are general shops, an engineering department, darkroom, library and the administrative staff.

Listed among the activities to be undertaken are: application of liquid metals as heat transfer elements; corrosion studies in connection with liquid metals and under special

(Continued on page 124)

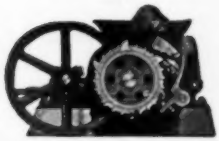
TUNNELS CONVEY ALL PLANT SERVICES

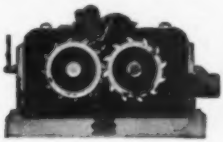
Below the floor of their new Springfield, Mo. plant, Lily-Tulip Cup Corp. has constructed a system of tunnels to carry electrical, water, gas, steam, steam condensate and liquid paraffin lines which serve the building and production machines. By eliminating overhead suspension, lighter wall construction was made possible. Accessibility also simplifies operation and maintenance

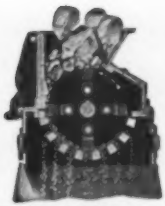


MUD HOG Crushers with traveling breaker plate

Single Roll, Double Roll and FLEXROLL Crushers







MIRACLE HAMMER Crushers for large capacities — large feed

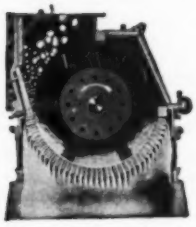
HIGH CAPACITY UNIFORM REDUCTION

A Complete Line of crushers, pulverizers, shredders for reducing all classes of material to desired size. Several types are shown.

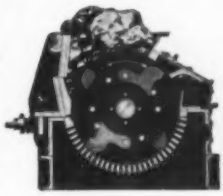
Built for specific applications — in a wide range of sizes — some with metal catchers — to suit capacity requirements.

Our modern test laboratory enables us to determine the proper type and size of machine best suited to the need in advance of expenditure or installation. Sample of material may be furnished, if desired, with results kept in strict confidence.

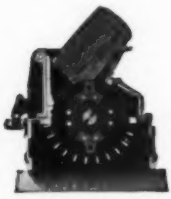
CRUSHER DIVISION



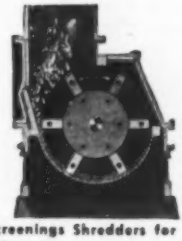
Type A Crusher with swing hammers



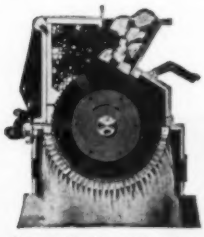
FLEXTOOTH and Rotary Ring Crushers



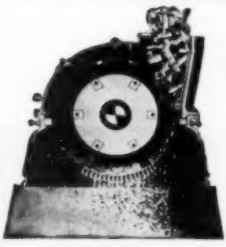
Bale Breakers, Pulp Lap and Crude Rubber Shredders



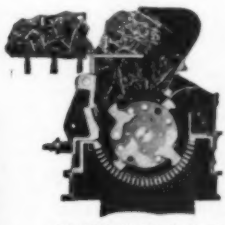
Screenings Shredders for chips, sewage, etc.



Type B Crusher with swing hammers



Type E Shredders for food or wood products



FLEXTOOTH Metal Turnings Crushers

ROCKBUSTER for reducing hard, friable material

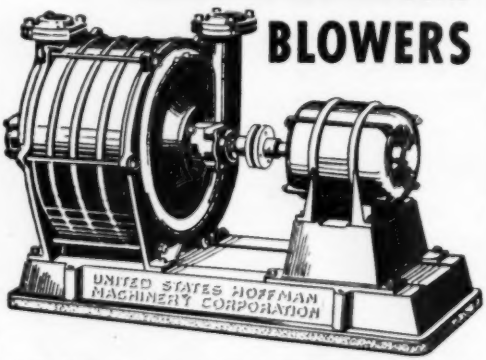
JEFFREY

1877 75 1952

When the Process Demands
CLEAN, DRY AIR
at constant pressure for

- Municipal activated sludge sewage systems
- Industrial activated sludge waste disposal systems
- Agitation of industrial acid neutralization systems
- Oxidation of industrial wastes for disposal
- Removal of cake from continuous filters
- Blow-back cleaning of sediment filter beds

Specify HOFFMAN
MULTISTAGE CENTRIFUGAL
BLOWERS



DELIVER AIR ENTIRELY FREE FROM ANY OIL, MOISTURE OR VAPORS. POWER INPUT VARIES WITH VOLUME HANDLED

Built for heavy-duty, continuous service . . . no internal moving parts, no internal lubrication to contaminate air. The standard for a variety of applications in paper mills, plating works, steel mills, textile mills, canneries, rubber plants, chemical works and auto plants. Models for a wide range of pressures and volume for air or gas. Write for Free Bulletin A-650.

HOFFMAN ALSO BUILDS HEAVY-DUTY INDUSTRIAL VACUUM CLEANING EQUIPMENT IN STATIONARY AND PORTABLE TYPES. *Write for Bulletins*

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U.S. HOFFMAN MACHINERY CORPORATION
300 EAST 12th STREET, NEW YORK 3, N. Y.
CANADIAN PLANT: CANADIAN HOFFMAN MACHINERY CO., LTD., NEWMARKET, ONT.

Spot news

(Continued from page 122)

conditions encountered in the atomic field; development of special types of instruments and instrumentation systems; development and fabrication of special metals and alloys for jacketing reactor fuel elements; exponential studies for reactor design; and pilot plant studies for determining design of full scale installations.

Texas Utility Installs Gas Turbine for Power Generation

Requiring a minimum of cooling water and utilizing natural gas as fuel, a simple open-cycle gas turbine is well suited for the southwestern Texas area. A 5000 kw unit of this type, manufactured by Westinghouse Electric Corp., was recently shipped to the Fort Stockton generating station of the West Texas Utility Co. Though only 42 ft long and 10 ft wide, the unit is capable of producing 6000 kw. It will operate at 5700 rpm, and will be connected to a 7500 kva, 3600 rpm generator by a reduction gear.

Trailer Carries Proportioning Equipment on Nation-Wide Cruise

Chemical feeding and proportioning equipment, manufactured by %Proportioneers, Inc.%, is being exhibited in a 40 ft motor trailer now touring the United States. This modern Yankee Clipper will visit all major cities including Chicago, Denver, Seattle, San Francisco, San Diego, Amarillo, New Orleans, Nashville and Pittsburgh.

Twenty tons of equipment from the smallest unit for chlorinating domestic water supplies to large proportioning pumps for industry are installed in the trailer and can be demonstrated. Units displayed can be used for a multi-

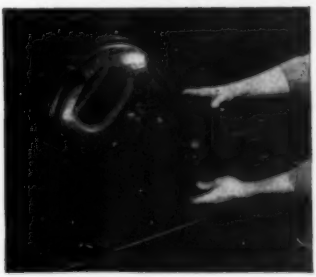
tude of operations—from adding fluorides to water, to accurately and continuously blending lube oil base stocks and additives in the production of motor oils. An attendant will be on hand to suggest applications of equipment for any process involving the mixing, blending, diluting or sampling of liquids. Visitors are welcome.

—End

A Maintenance Chief shows why he prefers two-piece QD design

1. "WE'VE STANDARDIZED ON THEM" says this maintenance chief about the Worthington QD sheave. Yes, the millwrights in his plant prefer the two-piece design of the QD sheave with the exclusive features that permit holding the hub on the shaft in a predetermined position and provide for locking the key to prevent drifting. See how easy it is to install QD hubs and sheaves in the pictures below.

2. "IT'S THE LIGHT WEIGHT OF THE QD HUB THAT MAKES INSTALLATION EASY." Without sheave rim obstructions, that easy-to-handle QD hub can be fitted to *oversize* or *undersize* shafts using a wedge for oversize fits. The QD hub is held in a predetermined position on the shaft when the flange cap screw is tightened. Drifting of the key is prevented by tightening of a flange set screw—another exclusive feature with the Worthington QD. And, of course, the QD hub comes off as easily as it goes on.



3. "HERE'S WHERE WE REALLY SAVE TIME AND TROUBLE." No juggling of a heavy rim and hub assembly to get it on a shaft with close-tolerance fits. The rim—with its large taper bore opening—slips easily over the small end of the taper QD hub—like threading a needle with a very *large* eye! A tight press-fit is assured as heavy pull-up bolts are tightened. There's no doubt about it—the friction-cone fit of the Worthington QD hub and rim grips the shaft tighter than any other sheave.

4. "ONCE ALIGNED, IT NEVER NEED BE RE-ALIGNED." That's a basic advantage with the QD, Mr. Maintenance Chief. Men like you know that the rim is easily removed using the heavy pull-up bolts as jack screws. If a speed change is called for, another size sheave can be slipped on the QD hub without disturbing alignment. If the QD hub is removed from the shaft for unit maintenance, it's easily positioned and held in place through the flange cap screw on re-assembly.

Worthington's complete line of Multi-V-Drives includes QD sheaves in all sizes, the QD juniors for fractional horsepower drives, and Worthington-Goodyear V-belts. *And you can get them fast!* Your distributor has a *complete* stock backed by the largest factory stocks you'll find anywhere. Send today for more information in Worthington Bulletin V-1400-B7F. Worthington Corporation, Multi-V-Drive Sales Division, Buffalo, N. Y.

MV.2.1

COMPRESSORS: AIR-COOLED, WATER-COOLED

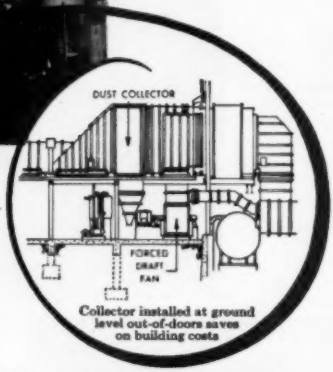
PUMPS: CENTRIFUGAL, ROTARY, STEAM, POWER

MULTI-V-DRIVES: QD SHEAVES AND V-BELTS

ALLSPEED DRIVES: WORTHINGTON ALLSPEED

Buy these Worthington standard products from your local distributor

Titus Station
Metropolitan Edison Co.
Reading, Pa.



Collector installed at ground level out-of-doors saves on building costs

Answer *your* specific dust control problems with an

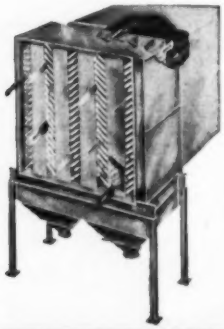
AEROTEC

DUST COLLECTOR
exactly tailored to your needs

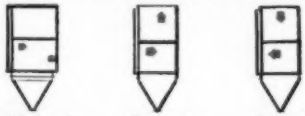
Here is one of the many instances in which the Aerotec Design 3 RAS Dust Collector proved its high efficiency so conclusively that Metropolitan Edison purchased a third unit. Gilbert Associates Inc., of Reading, Pa., were designers and constructors. Three bituminous coal-fired steam generators at this modern power plant, will be equipped with Aerotec Collectors. Layout and breeching are so designed that an Aerotec electrical secondary can be added at a future date without loss of the initial investment.

This mechanical collector, with its multiple, small-diameter tubes, offers you the advantages of high dust recovery in the ultra-fine ranges, even at partial load. The tubes are permanent mold aluminum castings of absolute uniformity. This construction provides the smooth inner wall necessary to ultra-fine dust collection. Tubes are assembled at the factory in lightweight "building block" sections. These assemblies permit flexible arrangement to suit your needs, with the economy of standard construction.

Let our engineers bring to your problems the benefits of their long experience in the field of flyash collection. No obligation.



Typical Inlet and Outlet Variations



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Project Engineers

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GREENWICH, CONN.

Review of recent books . .

Write to the publisher for books in which you are interested

Electronics

"Practical Industrial Electronics," by F. A. Annett. Order from Industry and Power, Reader's Service Dept., St. Joseph, Michigan. 381 pages with 369 illustrations. Price, $5.50.

Engineers and electricians confronted with installation, operation and maintenance of electronic equipment, but having little previous training in the subject, will find this book written expressly for them. The plainest sort of descriptions are incorporated—covering the electron itself, various tubes, fundamental circuits, more complex circuits and performance of many different control devices.

Described are such devices as electronic heating system controls, automatic systems of electronic combustion control, magnetic drive-speed control, motor-generator exciters, liquid-level and pump controls. Application, circuits and operation of rectifiers, relays, oscillators, smoke indicators and recorders, combustion safeguards and motor-speed controllers are discussed and illustrated. Electrical fundamentals and elementary circuits are treated in separate chapters. With simple explanatory treatment throughout, the book makes electronics easy to understand, instead of a mystery.

Meetings and exhibitions . . .

NOVEMBER

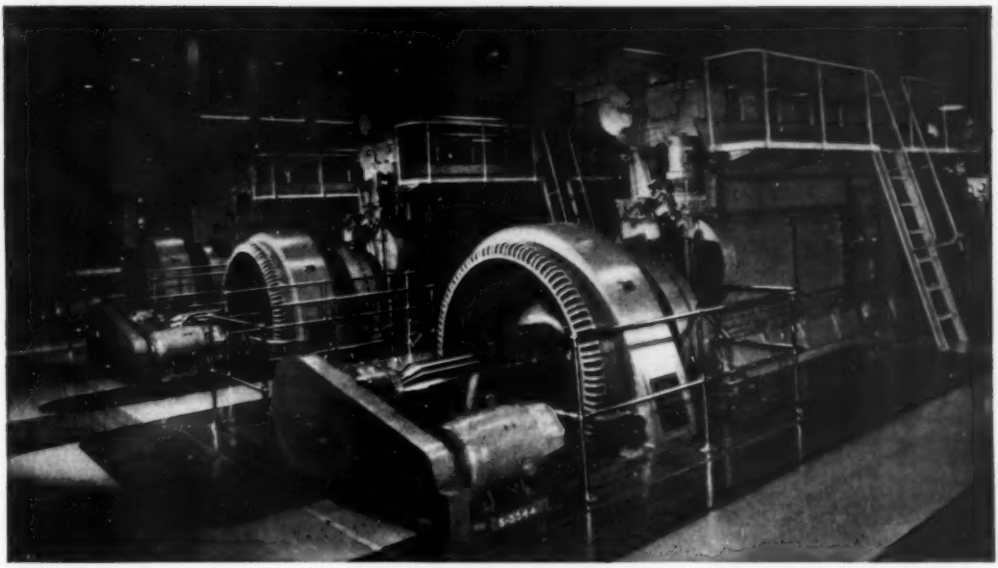
American Institute of Electrical Engineers will hold a Technical Conference on Recording and Controlling Instruments at the Benjamin Franklin Hotel, Philadelphia, Nov. 17-18.

National Association of Corrosion Engineers—Western Region holds its second Annual Corrosion Conference at the Biltmore Hotel, Los Angeles, Nov. 20-21.

DECEMBER

Twentieth National Exposition of Power and Mechanical Engineering, under the auspices of the American Society of Mechanical Engineers, will be held in Grand Central Palace, New York, Dec. 1-6. In conjunction, ASME will hold its annual meeting at the Hotel McAlpin, Nov. 30 to Dec. 5.

Society of Experimental Stress Analysis will hold its annual meeting and exhibition at the Hotel McAlpin, New York, Dec. 3-5.



Three Worthington 1160-kw capacity supercharged dual fuel Diesel engines in the Pittsfield, Illinois plant of the Illinois Rural Electric Company—an REA cooperative.

Dual Fuel Engines at Illinois Rural Electric Company Hold Fuel Costs Down for REA Cooperative

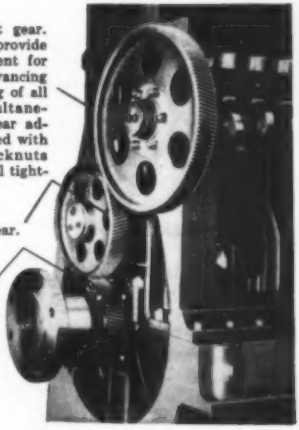
At present, the three Worthington Dual Fuel Engines at the new Illinois Rural Electric Company plant, just north of Pittsfield, are operating on oil. Later, when natural gas is available, they will operate as dual fuel units.

This REA cooperative serves rural consumers of electrical energy in an area of about 2,500 square miles in west central Illinois.

Although the plant is not yet fully loaded, engine performance has been in excess of 14 kwh per gal. of fuel oil with a load factor of 42 per cent. When engines are operating at full capacity, this performance will be even better.

Fuel consumptions on tests were as much as 6 per cent better than guarantees.

Worthington engines can always increase your plant's efficiency, lower your operating costs. For full facts on Worthington Dual Fuel or other engines, gas or Diesel, write Worthington Corporation, Engine Division, Buffalo, N. Y.



Main camshaft gear. Slots in gear provide single adjustment for retarding or advancing injection timing of all cylinders simultaneously. Final gear adjustment secured with castellated locknuts wired after final tightening.

Free floating idler gear.

Split gear keyed on crankshaft. Permanent adjustment for perfect alignment with idler gear is easily accomplished.

WORTHINGTON HELICAL STEEL GEAR TRAIN

1. Provides accurate and positive control of engine timing.
2. Location at flywheel end of engine results in smooth gear operation as power impulses are absorbed by the flywheel.
3. Controlled automatic oil-jet lubrication eliminates wear. Assures correct engine timing. Keeps engine running smoothly. Results in best fuel consumption and lower engine maintenance.

E-2.9

Worthington-Built Auxiliaries

Economical Continuous Power—Diesel Engines, 150 to 2,100 hp . . . Gas Engines, 190 to 2,100 hp . . . Dual Fuel Engines, 150 to 2,100 hp.

WORTHINGTON
Engines

WHY BUY MARLOW PUMPS?

ONE IMPORTANT REASON IS —you eliminate many headaches when you standardize on one good line of pumps throughout your system.

Marlow makes the world's most complete line of plunger sludge pumps for sewage disposal works. In four sizes and two types. Any capacity required. There are more Marlow plunger sludge pumps in use than all other makes combined.

Marlow makes the world's most complete line of engine and electric motor driven self-priming centrifugal pumps. From small portables to units of 240,000 GPH capacity.

Marlow makes the world's most complete line of engine and electric motor driven diaphragm pumps. 2 and 3 inch lightweight, 3 and 4 inch single and 4 inch double, heavy duty.

Furthermore, Marlow has the largest pump distribution and service organization and Marlow distributors service what they sell.

For complete details see your Marlow distributor or write the factory.

MARLOW PUMPS

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RIDGEWOOD, NEW JERSEY

The Standard of the Industry

News

of men and companies

SOCIETIES

American Welding Society—Elected F. L. Plummer, director of engineering, Hammond Iron Works, Warren, Pa., as its president. As head of the 8000 member society he will direct its activities for 1952-1953 upon taking office at the annual meeting. E. R. Seabloom, supvr field engineering, Crane Co. is elected first v-p and J. H. Humberstone, v-p, Air Reduction Co. Inc. is second v-p. New directors at large include G. H. Garrett, v-p, Thompson Pipe & Steel Co., and M. B. Lanier, president, Ingalls Shipbuilding Corp.

F. L. Plummer

HONORS

W. L. Batt, minister in charge of the Economic Cooperation Administration mission to the United Kingdom and former president of SKF Industries, Inc., is awarded the Howard Coonley Medal for long and distinguished service in the standardization movement. The American Standards Association presents the award annually to an executive "who by his practice and preachments has furthered the national economy through voluntary standardization." Presentation of the medal will be made on Nov. 25, at the 34th annual meeting of the Association in the Waldorf-Astoria, New York. This date has been changed from Nov. 19.

O. B. J. Fraser, assistant manager of the Development and Research Div., International Nickel Co., Inc., is the recipient of the Samual Wylie Miller Memorial Medal. The American Welding Society selected Mr. Fraser for this high honor for his studies of field applications and promotion of welding research.

For the second time the American Welding Society selected **H. S. Avery,** research metallurgist of the American Brake Shoe Co., as the winner of the 1952 Lincoln Gold Medal for his paper entitled, "Hard Facing for Impact."

ANNIVERSARIES

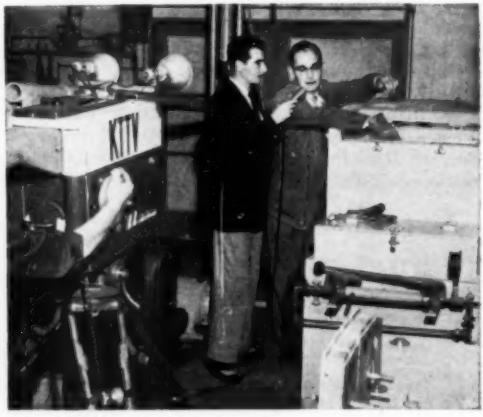
Dearborn Chemical Co.—Held its fourth annual 25-year Club dinner October 3, at the Hotel Sherman. Prominent among those in attendance was G. R. Carr, chairman of the board who, having joined Dearborn in 1901, enjoys the longest service record of any of the club's members. The dinner marked the 53rd anniversary of the company's incorporation.

The Gustav Wiedeke Co.—Recently celebrated its 60th anniversary and issued a commemorative booklet highlighting company products.

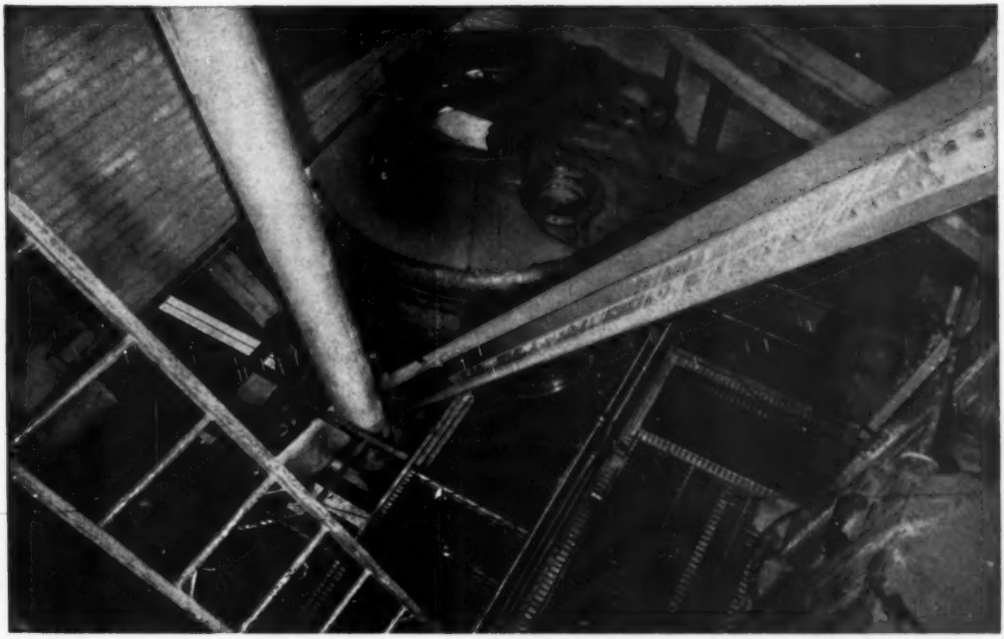
ANNOUNCEMENTS

H. K. Porter Co., Inc.—Acquires The Watson-Stillman Co., Roselle, N. J., manufacturers of forged steel fittings and hydraulic equipment, in a move to further diversify its operations. E. A. Stillman continues as president.

(Continued on page 132)



Featured on a recent television show over station KTTV, Los Angeles, was the story of the Chiksan Co., its products, and the processes used in making Chiksan ball-bearing swivel joints. Gus Bagnard, chief engineer, is shown describing a "torture chamber" test where the joints and assemblies are subjected to over 200 F



STAINLESS STEEL DEAERATING TANK is hoisted in place during construction of one of Detroit Edison Company's Heating Plants at Detroit, Michigan.

When CO_2 Caused a Headache ...Worthington Cured It

Detroit Edison had the solution to its problem —the problem of CO_2 in its steam—except for one thing.

Zeolite-softened municipal water used in their steam plant contains high percentages of carbonates which decompose and generate CO_2 in the boilers. Carried over with the steam into heating and processing equipment, that CO_2 could cause plenty of trouble.

The CO_2 problem was solved by Detroit Edison engineers by acid treating the softened water, converting the carbonates to CO_2. The gas thus formed is driven off in a deaerator.

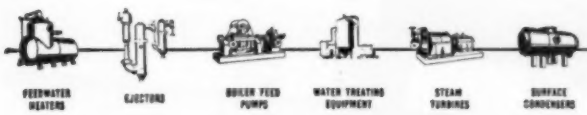
However, no standard deaerator could successfully remove the large quantities of CO_2 released by the acid treatment, and deliver water to the boiler with practically zero oxygen and zero CO_2. Furthermore, standard materials would have lasted only a few months under such conditions.

NON-CONTAMINATED STEAM

Worthington provided the answer. Detroit Edison engineers selected a Worthington deaerator specially designed for these severe conditions, built entirely of stainless steel, and guaranteed to deliver water containing not over 0.005 ppm of oxygen and not over 0.1 ppm of CO_2. The result is steam containing so little CO_2 that the amount *cannot be accurately measured!*

On problems like this one, Worthington not only furnishes *all* of the equipment needed in a complete water treating installation, but also has the engineering ability to work with your engineers on the *complete* problem of generating steam for power or processing. For further information on why *there's more worth in Worthington*, address Worthington Corporation, formerly Worthington Pump and Machinery Corporation, Steam Power Division, Harrison, New Jersey.

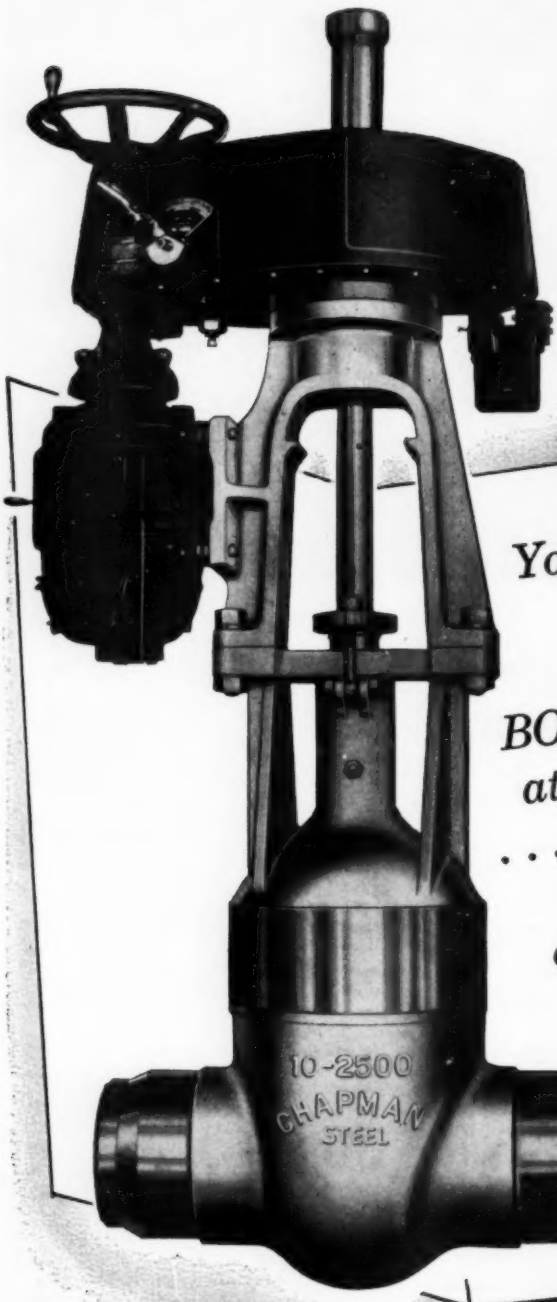
5.1.2



A GREAT TEAM IN STEAM

WORTHINGTON

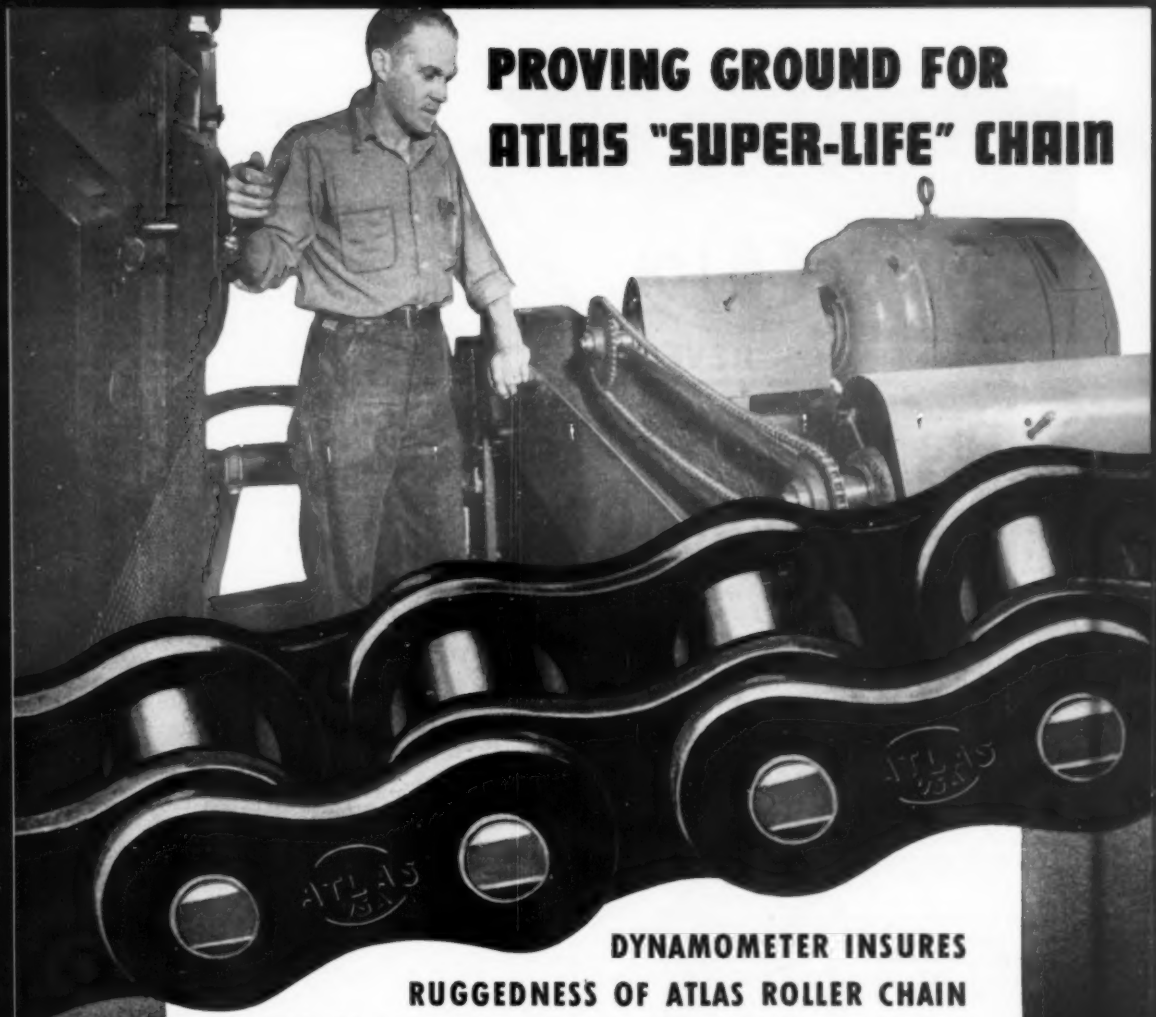
Feedwater Heaters



A Bid from Chapman

You are cordially invited to drop in at BOOTHS 46 and 47 at the Power Show . . . and to consult with sales and engineering staffs of The

CHAPMAN VALVE
MANUFACTURING COMPANY
Indian Orchard, Mass.



PROVING GROUND FOR ATLAS "SUPER-LIFE" CHAIN

DYNAMOMETER INSURES RUGGEDNESS OF ATLAS ROLLER CHAIN

In the Atlas laboratories, Dynamometer tests give final proof of the strength, life and economy of Atlas "Super-Life" Roller Chain. Here the results of all Atlas specifications and methods of manufacture are checked for top performance, under varying conditions of speed, load, and sprocket characteristics.

The Atlas Dynamometer provides a complete test of Atlas Chain's wearability, fatigue life, load-carrying capacity, and ability to withstand shock. As a result, you can be certain that every link of Atlas Chain will deliver more years of trouble-free service, more production for your power transmission dollar.

For greater efficiency, more economy, on every power drive, install Atlas "Super-Life" Roller Chain—the chain that speeds up production, cuts down maintenance. Write today for the new Atlas Catalog and Handbook.

ATLAS CHAIN & MANUFACTURING CO.
PHILADELPHIA 24, PENNA.

ATLAS

ATLAS ROLLER CHAIN

CONDITIONS DEMANDED

So- COE DEVELOPED

The WATER HEATER OF TOMORROW

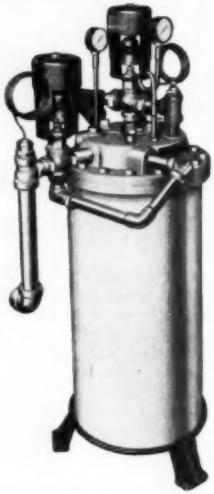
Here is a radically different water heater developed in response to a persistent demand. • It arrives completely assembled and tested. No accessories to buy and install. Simply attach a few pipes, then turn on steam and water. • Utilize abundant water at the safe temperature of 120° F. for washroom and showers. • And, if desired, you can pipe directly from the tank simultaneously for scalding water at 160° to 180° F. • Dependable regulators closely control temperatures. • Send the coupon for illustrated descriptive literature.

Heavily glass-lined A. S. M. E. tanks

Long life through minimum corrosion

MAXIMUM *Thermal Efficiency*

All parts quickly and easily accessible



Completely Insulated and Protected by Waterproof Cover

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Capacities 200 to 3000 G. P. M.

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SEND US YOUR LITERATURE DESCRIBING

THE COE SAFETY WATER HEATER

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Company _____

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City _____ State _____

News
of men and companies

(Continued from page 128)

The Trane Co.—Dr. N. F. Bisgaard, professor of heating and air conditioning at The Technical University of Denmark, Copenhagen, recently visited the firm's research laboratories as part of his tour of leading American manufacturers. Purpose of Bisgaard's trip is to learn about new American air conditioning, heating and heat exchange equipment; knowledge which he will impart to his students in Denmark and use as a consulting engineer in that country.

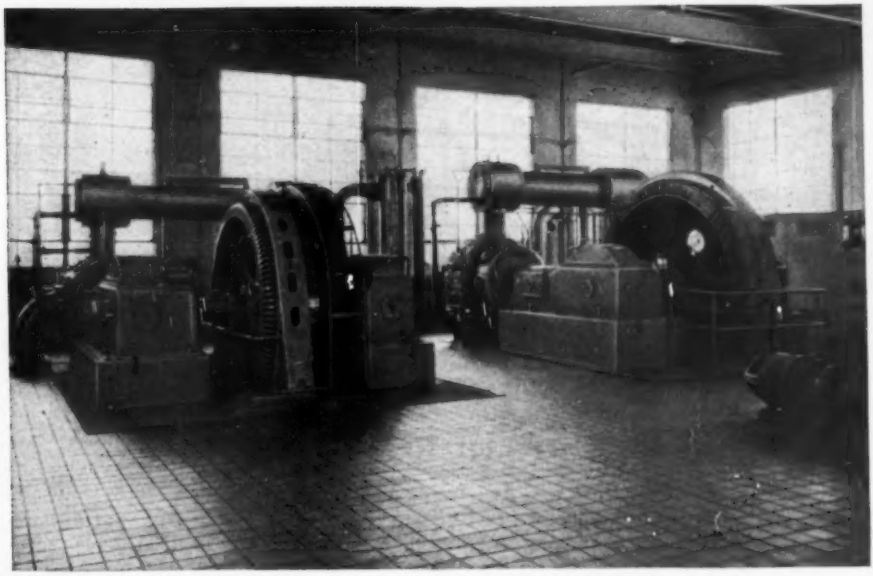
Cleaver-Brooks Co.—Selection of a new trade-mark, based on the "Promethean Flame" has been announced by the Cleaver-Brooks Co. The trademark depicts a hand holding the Promethean flame.

Westinghouse Electric Corp.—The U. S. Army Corps of Engineers has awarded Westinghouse a contract in excess of $1 million for the construction of a railway-mounted gas turbine power plant. Intended to be used as an advance power generation unit in devastated areas, the two-car plant will contain a 5000 kw, 5700 rpm gas turbine designed to burn diesel oil; a geared speed reducer to drive the generator at 3600 rpm for 60 c power, or at 3000 rpm for 50 c power; a 2400 v a-c generator; the generator exciter; and a starting motor for the gas turbine along with a multivoltage transformer, with output ranging from 2400 to 15,000 v; high and low voltage switchgear; and two diesel generators for auxiliary power, one of which will supply the starting motor. The cars will be subcontracted to the Puget Sound Bridge and Dredging Co. of Seattle, where apparatus will be installed and tested.

EXPANSIONS

Anaconda Copper Mining Co.—Announces the completion of the organization of its subsidiary, Anaconda Aluminum Co. (formerly Harvey Machine Co., Inc. of Montana). F. O. Case is elected president of the new company. The aluminum reduction plant will be built near Columbia Falls, in Flathead County, Montana. Two pot-lines together with accessory buildings and equipment, capable of producing 50,000 tons of aluminum annually, will be installed. Construction preliminaries on the $45 million project were begun soon after the announcement that the Anaconda interests had completed arrangements to obtain alumina for the operation from Reynolds Metals Co.

(Continued on page 134)



meet AIR DEMANDS economically

with O-CE COMPRESSORS, built for continuous, heavy-duty operation — in sizes up to 2,000 hp., for pressures to 5,000 lbs.

Of horizontal, double-acting, water-cooled type, with direct-mounted synchronous motor drive, these compressors are unsurpassed for dependable, low-cost performance.

- ✓ Equipped with roller bearings throughout.
- ✓ Quick-acting Simplate valves minimize power consumption.
- ✓ Large, stream-lined air passages make air flow resistance negligible.
- ✓ CP Multi-Step Control handles partial load demands economically.
- ✓ CP Automatic Starting Unloader completely unloads compressor when starting and stopping, and permits automatic restarting after power failure.
- ✓ CP Intercooler assures maximum heat transfer with low water consumption.

Write for full information.

CP Fiftieth ANNIVERSARY

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

Controlled Pressure

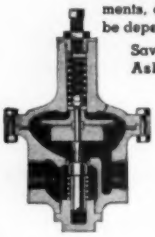
for efficient operation

Clark Pressure Reducing and Regulating Valves

are precision-made for positive pressure control on air, gas or steam lines.

Where different types of equipment, with varying pressure requirements, are operated from a common line, Clark Regulating Valves can be depended on to deliver automatically the "just right" pressure to each.

Save on fuel, maintenance and protect expensive equipment. Ask your Clark representative to specify the right Clark valves for your needs . . . or write us direct.

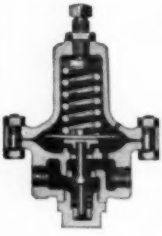


TYPE KRV

Pressure Reducing Valve. Diaphragm Operated-Single Seated Valve. Sizes ½" to 1½" for initial pressures up to 250 P.S.I. Reduced pressures to 85 P.S.I.

TYPE CRV

Pressure Reducing Valve. Integral pilot controlled, piston operated. For pressure control from "dead end" to full capacity. Sizes ½" to 6".



TYPE ORV

Pressure Reducing Valve. ⅜" and ½" Single Seated, Spring Loaded, Diaphragm Actuated. For initial pressures to 250 P.S.I. Reduced pressures to 200 P.S.I.

QUICK-CLEANING STRAINERS

Remove dirt, scale and grit from steam, fluid and gas lines. Sizes ½" to 3" I.P.S. For pressures to 250 P.S.I.

THE CLARK MANUFACTURING COMPANY

1830 East 38th St. • Cleveland 14, Ohio

Clark

THE HOME OF DUO STEP LEVERAGE

The complete line of dependable fluid controls

News

of men and companies

(Continued from page 132)

Lindberg Engineering Co.—Purchased 4½ acres of land adjoining the Southern Pacific Railroad tracks in Los Angeles, Calif. where it plans the building of a plant and offices.

Westinghouse Electric Corp.—Will expand its manufacturing operations in the Boston area soon with a $1¼ million building project at its Sturtevant Div. plant in Hyde Park, Mass.

General Electric Co.—Began construction of new $1,690,000 service shop and warehouse, designed to serve the industrial needs of Metropolitan Philadelphia and the Delaware River Valley regions. The new structure will take up 130,000 sq ft of floor space and is scheduled to go into operation in August, 1953. Construction of the new facility has been awarded to Leonard Shaefter Co., contractors. Kuljian Corp. is consulting engineer on the project.

NEW REPRESENTATIVES

Elgin Softener Corp.—Appoints Samson Sales Co. as representative for central and northern California and Nevada, with headquarters at 420 Market St., San Francisco.

Insul-Mastic Corporation of America—Is now represented in the Territory of Hawaii by the firm of Craig & Pullen, 338 Ward Ave., Honolulu.

Owens-Illinois Glass Co.—The H. S. Chaffee Co., Inc., in Liverpool, New York is appointed distributor-applicator for Kaylo Heat Insulation.

SALES OFFICES

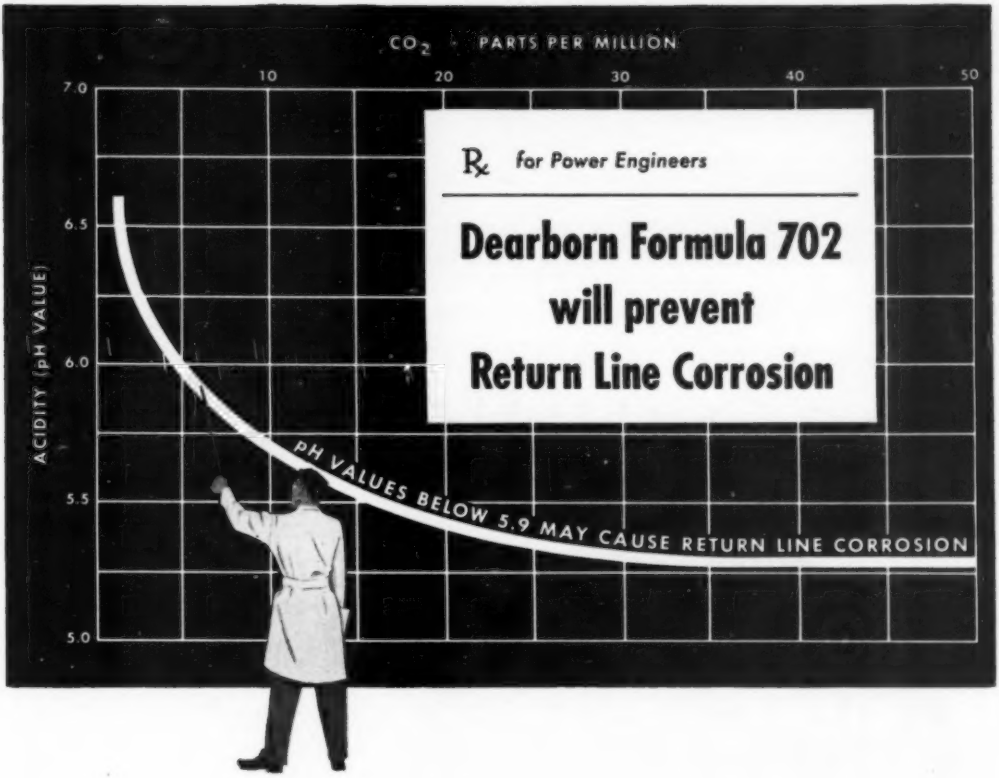
The Babcock & Wilcox Co.—The Tubular Products Div. opens new office in Syracuse, N.Y. with J. Y. McCandless in charge. The office is located at 205 Harrison St.

Bridgeport Brass Co.—D. F. Snow, district sales mgr, heads the new warehouse in Philadelphia at 918 E. Lycoming St.

National Electric Products Corp.—A new district office opens in Salt Lake City, Utah, with J. Longden named district mgr. The new offices are in the Union Pacific Annex, which faces on Temple Square. G. Morrell is appointed office asst.

The Swartwout Co.—Announces establishment of a district sales office at 143 Broadway, Cambridge, Mass., under the direction of R. E. Alexander, district mgr. Alexander will replace G. H. Thompson who is to represent the company in Florida. A. G. Bowry, previously associated with Thompson, is appointed to represent the Industrial Ventilation Div. His headquarters are 5 Arlington St., Cambridge, Mass.

(Continued on page 136)



℞ *for Power Engineers*

Dearborn Formula 702 will prevent Return Line Corrosion

What's the pH value of your boiler feed water? Chances are that if it's 5.9 or lower, you have return line corrosion—caused by excessive quantities of dissolved carbon dioxide and oxygen.

Corrosion caused by a low pH is effectively prevented with Dearborn Formula 702. This effective Dearborn treatment, which is introduced directly into the boiler feed water, works three ways. First, it forms a continuous amine film on the return lines to prevent corrosion. Second, this same film improves heat transfer, thus lowering the cost of steam production. Third, Formula 702 will automatically repair the film broken by rust scale separating from the pipe.

It will pay you to learn more about how Formula 702 will reduce excessive maintenance, avoid shutdowns, protect valuable equipment. Why not call your Dearborn Engineer today?

DEARBORN CHEMICAL COMPANY
Merchandise Mart Plaza • Chicago 54, Illinois

BASIC PATENTS

Dearborn holds the basic patents (U.S. Pat. 2400543) for the use of filming amines for treating water.

YOU'LL WANT A COPY OF THIS BULLETIN

Bulletin 5013, which outlines the causes of return line corrosion and the method of cure with Formula 702, will be sent on request.

Dearborn Chemical Company, Dept. INP
Merchandise Mart Plaza
Chicago 54, Ill.

☐ Send a copy of Bulletin 5013
☐ Have a Dearborn Sales Engineer call

Name.....
Company.....
Position.....
Address.....
City.....*Zone*.....*State*.....

Dearborn
TRADE MARK REGISTERED
THE LEADER IN WATER TREATMENT AND RUST PREVENTIVES

News

of men and companies

(Continued from page 134)

Syntron Co.—The Syntron Birmingham Sales Co. announces the opening of new offices at 1831—29th Ave., So., Birmingham, Ala. Sales operations are under the direction of A. H. Brush, recently associated with the Syntron Baltimore Sales Co.

Yeomans Brothers Co.—Opens new plant and general offices at 1999 N. Ruby St., Melrose Park, Ill. In addition a new sales and service office is opened at 510 N. Dearborn St., Chicago.

APPOINTMENTS

Allis-Chalmers Manufacturing Co.—J. D. Greensward is named v-p, director of manufacturing, general machinery div. P. F. Bauer succeeds Greensward as genl mgr of the Norwood Works and mgr of the apparatus dept. W. L. Ringland is appointed chief engineer of the motor and generator section of the power dept. Other new motor and generator section appointments include J. F. Sellers, asst chief engineer; L. T. Rosenberg, engineer-in-charge of a-c design, and Chester Weilbaecher, engineer-in-charge of d-c design. W. C. Sealey is named chief engineer of the transformer section of the power dept. Other new transformer section appointments include K. P. Wiederkehr, engineer-in-charge of transformer design; R. P. Marohn, engineer-in-charge of regulator design, and D. T. Seag, engineer-in-charge of betatron design. New chief engineer of the switchgear section of the power dept is T. G. A. Sillers. J. F. Dawson is named engineer-in-charge of induction heating sales in addition to his former capacity as engineer-in-charge of induction heating design of the electronics section. In his capacity as engineer-in-charge of induction heating sales, Dawson succeeds J. R. Roe, resigned.

American Engineering Co.—Announces appointment of H. Pagels as

H. Pagels **F. C. Messaros**

v-p in charge of manufacturing, and of F. C. Messaros as v-p in charge of engineering.

Alloy Steel Products Co.—Appoints H. V. Evans, Jr., district mgr in Wilmington, Delaware. His headquarters are at 226 West Ninth St. E. J. Lickwar replaces Evans as sales representative in Pittsburgh.

Bigelow - Liptak Corp. — Announces transfer of L. E. Brungraber from the engineering dept to the sales staff in New York City. He will work out of the New York office at 50 Church St.

Boston Woven Hose & Rubber Co.—Promotion of H. S. Johnson to director of merchandising, L. M. Atwood to asst general sales mgr and J. H. Alsen to director of engineering applications is announced.

BullDog Electric Products Co.—R. O. Reinhardt joins the company as a field engineer in the St. Louis, Mo. area. Headquarters are at 3738 Washington Ave. W. F. Maegli is added to the Milwaukee sales staff. J. A. McGonegle is appointed to the Cincinnati district sales force.

Cummins Engine Co.—E. D. Tull is named to the newly created position of v-p and genl mgr. He will be responsible for coordinating the work of the five divisions of the company.

Dravo Corp.—Names W. L. Newhall director of the dept of research and development. New asst directors are C. R. Horton, Jr., and A. J. Liebman.

(Continued on page 140)

Over

7,000,000 Sq.ft.

Protect the Nation's Industrial Floors!

KLEMP
We Tread the World with Safety

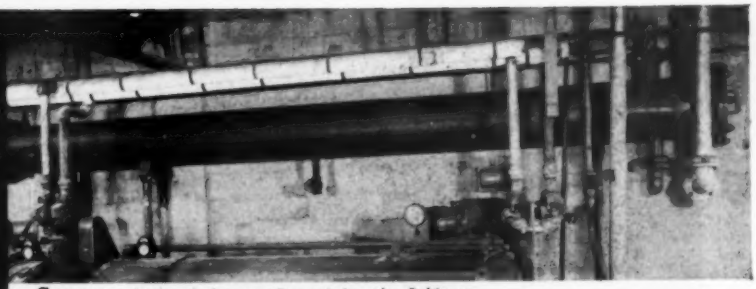
Such universal acceptance is no accident! Klemp's patented reinforcement armors eliminate chipping, cracking, creeping, splintering, spalling, and disintegration. Ruts and pot-holes do not form. They provide countless industrial users with the solidest, safest, most enduring floors of accurate level. This is why Klemp floors are still in perfect condition after more than 25 years! You, too, can protect *your* floors by following these two simple steps: (1) send for the free Klemp booklet: "Instructions for Laying Klemp HEXTEEL and FLOORSTEEL"; (2) call upon Klemp's free engineering service. ACT TODAY!

KLEMP METAL GRATING CORPORATION

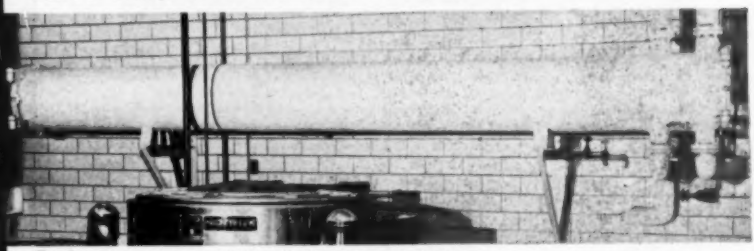
EXECUTIVE OFFICES: 1377 NORTH BRANCH STREET, CHICAGO 22, ILLINOIS

Actually cuts fuel costs

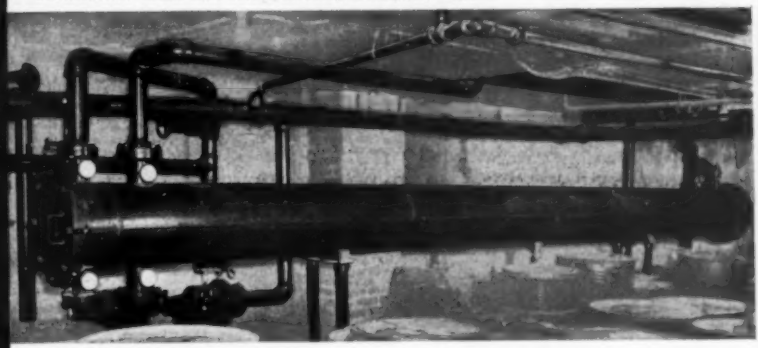
1/3 or more



Saves a third on fuel costs at Domestic Laundry, Baltimore



Reduces boiler load 30% at St. Joseph's Hospital, Elmira



Eliminates an extra boiler at Brown's Laundry, Allentown

How much coal are you firing down your sewer?

Typical users of Kelley waste water heat reclaimers are saving up to one-third of fuel costs—$4000 per year at United Laundries in Boston for example!

Such important Btu savings are also being made wherever hot water is wasted.

Heating fresh water with waste water heat, saving money on fuel, here's a sure way to cut operating costs. Boiler load is reduced—boiler life extended.

Installation of Kelley hot waste water heat reclaimers is easy enough—because they fit in any otherwise unused out-of-the-way space of sufficient size.

All these advantages are yours with a heat reclaimer system. It will cost you nothing to get full information on **p-k** heat reclaiming equipment, storage heaters and condensate coolers. Write now for catalog No. 310. Engineering help is yours without cost or obligation. Don't pour dollars down the drain—get the facts NOW!

the **Patterson-Kelley Co.,** *Inc.*

1210 Burson Street, East Stroudsburg, Penna.

1903-A

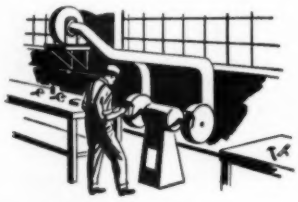
381 Park Avenue, New York 17 • Railway Exchange Building, Chicago 4 • 1700 Walnut Street, Philadelphia 3 • 96-A Huntington Avenue, Boston 16 • and other principal cities

American Blower... a time-honored name in air handling

Philadelphia has a conveniently located American Blower Branch Office to provide you with data and equipment for air handling. You can reach American Blower in Philadelphia by calling Rittenhouse 6-8873. In other cities consult your phone book.

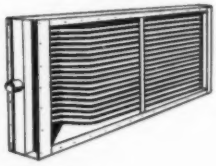
EMPLOYEE COMFORT

Fresh, invigorating air, indoors, does much to increase employee morale and efficiency. American Blower Ventura Fans are ideal for the job. They're attractively streamlined propeller fans with smooth-flowing lines that harmonize well with modern business interiors. Wiring is fully enclosed for safety. A square mounting panel makes them easy to install. All Ventura Fans are sound-rated and capacities are Certified.



ABRASIVE MATERIALS

If you've found dust from grinding machine operations hard to handle, American Blower Type V Fans are well worth investigating. The heavy cast-iron housing of Type V fans easily withstands the wear of hard, gritty, abrasive materials. Also, their volume and pressure range is more than adequate to handle the normal requirements of this type of work. Remember, good ventilation is good business.



HEATING COILS

Current demands for heating from business and industry are greater now than ever before – a good reason to take early action on American Blower Heating Coils. Whether you need coils for use in blast heating or zone reheating – you'll find the size and type to fit your needs in the American Blower line. All tubing is helically wound with copper or aluminum fins in 3 standard spacings. Casings are heavy galvanized steel; headers are die-formed steel.

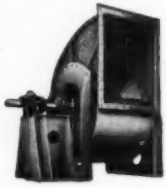
YOUR BUSINESS

Whatever your needs, American Blower heating, cooling, drying, air conditioning and air handling equipment will improve over-all comfort and efficiency in your business. For data, phone or write our nearest branch office.

Unit Heaters

Ventura Fans

Centrifugal Compressors



Industrial Fans

Utility Sets

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

YOUR BEST BUY **AMERICAN BLOWER** AIR HANDLING EQUIPMENT

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

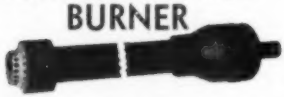
JOHN ZINK JZ SERIES YC

COMBINATION GAS & OIL BURNER

The John Zink Series YC Combination Gas and Oil Burner is particularly designed for boilers and process furnaces where maximum heat release at low excess air and high heat density place a premium on reliable burner performance at low first cost.

MAXIMUM DUTY — MINIMUM DRAFT.
RUGGED WEATHERPROOF CONSTRUCTION.
SIMPLE IN DESIGN.
LIGHT-WEIGHT FUEL GUNS ARE EASY TO REMOVE.
BURN ANY COMMERCIAL FUEL OIL.
BURN ANY GAS AT REASONABLE PRESSURE.
DRAFT MAY BE NATURAL, INDUCED OR FORCED.
CHROMIUM ALLOY STEELS FOR HEAT AND CORROSION RESISTANCE.
CENTER FIRING WITH BOTH FUELS ASSURES EQUALLY SATISFACTORY OPERATION WITH EITHER FUEL.
ANY AIR TEMPERATURE MAY BE USED.

Between-the-Tube BURNER



The application of the John Zink patented ST Gas Burner to industrial or power boiler installations is a radical improvement in boiler firing.
It is not necessary to form the tubes around the burner to secure maximum heating efficiency. Flame contact is equalized along all heating surfaces.
Furnished in groups of heads. Fires directly over stoker.

JOHN ZINK FIELD FLARE For . . .

- OIL REFINERIES
- CHEMICAL PLANTS
- STEEL MILLS
- GASOLINE PLANTS
- SEWAGE DISPOSAL PLANTS

or any industrial facility where substantial volumes of combustible gases must be dissipated.

JOHN ZINK COMPANY

4401 So. Peoria — Tulsa, Oklahoma

No Refractory Cement Ever Like It

for

Bonding or Patching

the Brickwork in Linings, Settings, Floors, Doors, Arches, Baffles, Jambs, Flues, Blocks and Special Shapes in Power Boilers and Furnaces; Coke Ovens, Gas Producers and Generators; Blast Furnaces, Soaking Pits, Foundry Cupolas and Ladles; Forging, Heat Treating and Annealing Furnaces; Metal Refining, Melting and Roasting Furnaces, Oil Cracking Stills; Ceramic Kilns and Incinerators.

Super #3000 "That Wonder Cement"

SETS HARDER

BONDS STRONGER

LASTS LONGER

- Ready Mixed-Plastic
- Matchless for Resistance to Flame Erosion and to Abrasion
- Withstands both High and Low Temperatures BETTER
- Adhesive—Durable
- Reduces Spalling

You, too, can discover — as have many steel plants through experience — how this amazing air-setting bonding cement definitely cuts maintenance troubles and frequent repairs, especially where service is severe. Make your own test — try Super #3000. You'll wish you had — much sooner.

Test It Yourself

Please send at once

☐ Catalog and prices.
☐ Name of nearest distributor.

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City_____ Zone____ State_____

REFRACTORY & INSULATION CORP.

130 WALL STREET • NEW YORK 5, N. Y.

News

of men and companies

(Continued from page 136)

DeLaval Steam Turbine Co.—Announces appointment of R. G. Baker as regional sales representative over the territories of the Chicago, Detroit and Minneapolis operations. He will continue to make his headquarters in Chicago where he has been district manager since 1934. C. C. Bray is named mgr of the Chicago district office.

Fireye Corp. — Appointment of J. Caldwell as eastern sales mgr is announced. Eastern sales offices are maintained at One Broadway, New York City.

Flexrock Co.—New protective coatings div is headed by J. G. Wild.

General Electric Co.—F. M. Clark, div engineer of the materials and process div of the general engineering laboratory is designated a United States representative to the International Conference on large electric systems, which meets every two years at Paris, France. As official U. S. representative, he will head a committee on insulating liquids for high voltage application. Purpose of the committee is to study characteristics of insulating liquids and to assist in international standardization of insulating methods. The Construction Materials Div. announces appointment of M. Bizzarro as district representative in the New York district. He will handle three Construction Materials lines—wiring devices, wire and cable, and conduit products. His office will be at 570 Lexington Ave.

Acme Electric Corp.—Directors of the company have advanced C. H. Bunch from the presidency to chairman

J. A. Comstock C. H. Bunch

of the board, and also have elected J. A. Comstock as president. Comstock formerly served as executive v-p.

The Lincoln Electric Co.— H. A. Burnip is named director of purchase engineering. As head of purchase engineering, he will be responsible for developing new materials, lower cost substitute materials, establishing purchasing and quality control specifications and either new or improved processes and methods to permit the better and more economical manufacture of welding equipment.

(Continued on page 142)

Have you a fly ash recovery problem?

Bring it to WESTERN PRECIPITATION

... The Only Organization With Years Of "Know-How" In BOTH *Electrical* And *Mechanical* Recovery Methods!

If you have any kind of a suspension-recovery problem—whether dust, fly ash, fume, fog or mists—it will pay you to bring it to the leading organization in the field ... WESTERN PRECIPITATION CORPORATION. Western Precipitation not only pioneered, over 44 years ago, the first commercial application of the now-famous COTTRELL Electrical Precipitators, but also has been a leader for many years in the *mechanical* recovery field with its widely-accepted MULTICLONE Collectors.

Result:

Western Precipitation is unsurpassed in the all-important factor of "know-how" in BOTH the electrical and mechanical fields ... knows from years of first-hand experience whether your particular problem can best be solved by mechanical or electrical methods—*or by a combination of the two* ... can give you a direct and unbiased recommendation on the matter ... and then can provide the complete installation under *one* responsibility, *one* overall performance guarantee, even where Combination Multiclone-Precipitator (CMP) installations are made!

Western Precipitation products and services include ...

COTTRELL

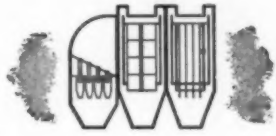
Electrical Precipitators

... the most efficient recovery equipment for high recovery, long life, low maintenance on practically any type of suspensions, wet or dry. COTTRELLS can be designed to handle a few c.f.m. —or millions—with equal ease, and at virtually any operating temperature. Recovery efficiencies closely approach 100% recovery, if desired, with very low draft loss, minimum power costs and negligible labor costs. *By all standards, Western Precipitation* COTTRELLS *give highest recovery at lowest cost per-year-of-service!*

MULTICLONE

Mechanical Collectors

... the most efficient, most compact, most trouble-free mechanical equipment for recovering suspensions from gases. Because of their unique small-tube design, MULTICLONES are unsurpassed in mechanical recovery efficiencies—require less space, less maintenance, and are far simpler to install. No filters or screens to replace, nothing to burn or cause fire hazards, no high speed moving parts to repair or replace. These and many other advantages make MULTICLONE Collectors the logical choice on installations where mechanical recovery is selected.



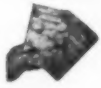
CMP UNITS

(Combination Multiclone-Precipitator)

... combine, in *one* compact installation, both mechanical and electrical recovery principles so that maximum benefit is obtained from the advantages inherent in each method. The MULTICLONE section centrifugally removes the larger and heavier suspensions (down to a few microns in diameter) ... and the COTTRELL section then electrically removes the very small particles remaining in the gases. Thus, the bulk of the recovery is obtained with relatively low-cost equipment, and the final clean-up is obtained with equipment having unusually high recovery efficiency—approaching theoretically perfect, if desired.

The recovery of suspensions from gases is a highly exact science and every problem is different. Some require mechanical methods—others electrical methods—still others a combination of mechanical and electrical methods in proper balance to meet the individual requirements of each application. No matter what your problem, remember that only Western Precipitation has had years of field experience in BOTH mechanical and electrical methods!

Send for descriptive literature!



Let our experienced engineers study your recovery requirements and make an unbiased recommendation on the equipment best suited to your particular problem. A wire, phone call or letter to our nearest office places this unique "know-how" at your service, without obligation.

WESTERN Precipitation CORPORATION

ENGINEERS, DESIGNERS & MANUFACTURERS OF EQUIPMENT FOR COLLECTION OF SUSPENDED MATERIALS FROM GASES & LIQUIDS

Main Offices: 1026 WEST NINTH STREET, LOS ANGELES 15, CALIFORNIA
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PRECIPITATION CO. OF CANADA, LTD., DOMINION SQ. BLDG., MONTREAL

MULTICLONE—T.M. Reg.

COMPACT

within arms' reach

MORE STEAM

in LESS SPACE... at LESS COST!

The Clayton Forced Recirculation Steam Generator produces more steam per pound of weight and per cubic foot of space occupied than any boiler known... and at less cost. Fast steaming, automatic and safe, the Clayton Generator sets a new standard of efficiency for the production of processing steam. It is the only steam generator with a cost curve that parallels the load demand curve through all stages of operation. Each unit... 15 to 100 h. p.... is complete, ready to connect and operate upon delivery. No burners, pumps, instruments or accessories to buy.

THIS COUPON BRINGS PROOF TO YOUR DESK

An animated, colored flow chart shows you how and why the Clayton Forced Recirculation principle can cut your steam costs.

IP-11

CLAYTON MANUFACTURING COMPANY
Box 550, EL MONTE, CALIFORNIA

Send name of nearest distributor and arrange desk demonstration of Clayton Forced Recirculation principle. Send catalog.

NAME_____

FIRM_____

ADDRESS_____ STATE_____

CITY_____

Clayton

MANUFACTURING COMPANY
Box 550, EL MONTE, CALIFORNIA

News

of men and companies

(Continued from page 140)

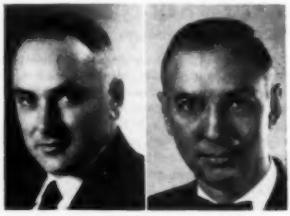
The B. F. Goodrich Co.—T. G. Graham, v-p since 1928, will retire January 31, 1953. At the time of Graham's retirement A. Kelly, with the company since 1925, will become v-p manufacturing.

Harnischfeger Corp.—Celebrated offical opening of their new sales office, warehouse and service station in Birmingham, Ala. with an open house and barbecue. This opening also announces the consolidation in Birmingham of all territory formerly served by P & H offices in Memphis, Tenn. and Jacksonville, Fla., although sales representation is retained in these cities. Moving up from his position as Memphis district mgr to take charge of the new plant and territory is R. M. Calkins.

Honan-Crane Corp.—Announces appointment of D. J. Jones as general sales mgr.

National Electric Products Corp.—Appointment of J. L. Myers as products engineering mgr in charge of design, manufacture and inspection of its complete line of outlet and device boxes, electric metallic tubing fittings and box and cable connectors, is announced.

The Permutit Co.—Adds F. W. Saco to its mechanical engineering dept where he assumes the position of mechanical development engineer.



F. W. Saco R. L. Bernhard

American Blower Corp.—Establishes a separate centrifugal compressor dept with R. L. Bernhard named mgr. E. W. Petersen is made general sales mgr.

J. F. Pritchard & Co.—K. E. Johnson, formerly Chicago district sales mgr, is named to succeed R. C. Kelly as mgr of the equipment div in Kansas City. Succeeding Johnson in Chicago is E. A. Bailey. Kelly resigned to accept the position of executive mgr of the Cooling Tower Institute.

Quaker Rubber Corp.—Names M. B. Beline to the newly created post of director of national accounts where he will coordinate the activities of field personnel with the factory to provide the fullest assistance on preliminary engineering, specifications and service to national accounts and the government.

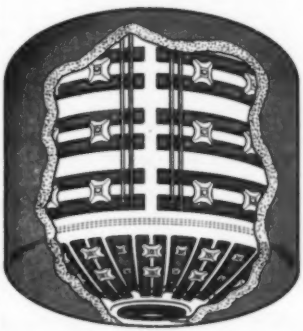
(Continued on page 144)

Industry's Most Versatile Heat Source

Chromalox *Electric* Strip Heaters

Easy to Install CHROMALOX Electric Strip Heaters give clean, dependable and accurately controlled heat where and when heat is needed. They produce uniform and accurate temperatures by automatic or manual controls. Low initial costs, low installation costs and low operating costs are among the many advantages of using CHROMALOX Strip Heaters for heating liquids, gases, viscous fluids, tanks, platens, molds, moving parts, etc. Get the full details now.

A Typical Strip Heater Application from Our Files



Rugged, easily installed Chromalox Strip Heaters assure accurate temperature, dependable around-the-clock service.

Strip Heaters curved lengthwise at the factory fit snugly to tank perimeter and . . .

Strip Heaters curved slightly as installed conform to shape of convex kettle bottom, while . . .

Segment Heaters fill the gaps.

IC-88

CHROMALOX

Electric Heat for Modern Industry

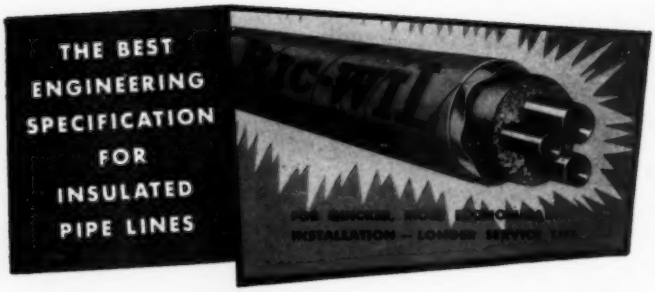
Sizes, Types and Sheaths for Every Need
LENGTHS
4" to 96" lengths, ½" to 2½" widths, rings 2½" to 11" diameter, 115 to 460 volts
CURVES & SEGMENTS
Curved in cross-section or formed lengthwise to desired radii
TERMINALS
Varied terminal types for convenient wiring. 2 terminals at one end, centered, or at opposite ends. 3 terminals at some end of the unit
SHEATHS
Rust-resisting iron, high temperature steel and Monel sheaths to meet exact service conditions

Want Ideas?

on how to use Chromalox Electric Heaters in your plant

Write for the data-packed Catalog 50 which describes many types of Chromalox Electric Heaters and how to apply them. It's yours without obligation.

EDWIN L. WIEGAND COMPANY
7520 Thomas Blvd., Pittsburgh 8, Pa.

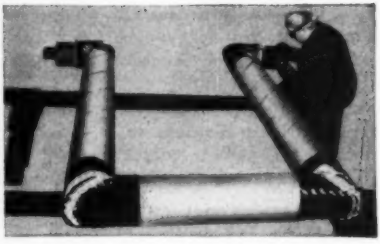


COMPLETE PROTECTION

Ric-wiL HEL-COR Units are designed for severe service conditions. The strong, shock-proof housing is 16-gauge Armco ingot iron, spirally-corrugated, hot-dipped galvanized, and rust-proofed "Bonderized." Outside is given a ⅛" thick covering of high-melting point asphalt and asbestos felt, and inside coated with phenolic resin, baked-on — a multiple layer of protection against moisture and corrosion.

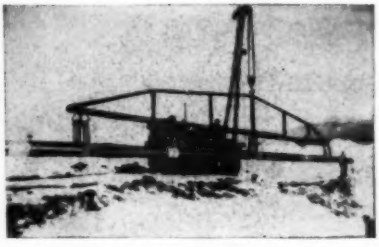
CERTIFIED WELDING

Built by skilled craftsmen, all Ric-wiL systems are designed and welded to comply with the requirements of the A. S. M. E. Code for Pressure Piping, and we are authorized to apply the appropriate Code symbols. Piping and conduit are rigidly inspected and tested before leaving our factory — your assurance of trouble-free piping performance.



PREFABRICATED UNITS

All parts and fittings, including complete expansion loops or packless-type joints, are delivered to job site in easily-handled units of sound engineering design — eliminating many installation steps entirely and lowering final costs. These versatile units may be safely installed under city streets, railroad tracks, or suspended overhead.



Ric-wiL Systems range in size from 6" conduits to giant 84" diameter Utilidors designed to carry all utility services. Put Ric-wiL's broad experience to work for you — ask us for latest literature or discuss your next piping project with a Ric-wiL representative.

THE RIC-WIL COMPANY

Mfgrs. Insulated Piping and Conduit Systems

UNION COMMERCE BLDG. • CLEVELAND, OHIO

LEADERS IN INSULATED PIPING PROTECTION

News

of men and companies

(Continued from page 142)

Republic Rubber Div.—This div of Lee Rubber & Tire Corp. names W. H. Hunter asst sales development mgr.

Standard Pressed Steel Co.—L. C. Fuqua is appointed a sales representative and assigned to the Chicago office.

Sterling Engine Co.—G. D. Thomas joins the company's application engineering field sales staff.

Edwin L. Wiegand Co.—E. E. Bolds, of Cleveland, is elected a director of the company.

Westinghouse Electric Corp.— R. H. Timmons is named mgr of the steam div at South Philadelphia, Pa.

Bowser, Inc.—Appointment of R. L. Holt as v-p is announced.

R. L. Holt **M. C. Meyer**

Republic Rubber Div.—M. C. Meyer is promoted to mgr of wire braid hose sales for this div of Lee Rubber & Tire Corp. Meyer, in his new position, will direct the sales activities of the division's new line of wire braid hose now being produced in a new $2½ million plant addition. He will headquarter in Youngstown.

Worthington Corp. — Promotes five engineers to new posts. J. E. Lancaster is appointed asst chief engineer of the air conditioning and refrigeration engineering div. W. C. Osborne is named mgr of the research and development dept. N. L. Meyerson is promoted to asst mgr of the research and development dept. F. C. Gilman assumes the position of research engineer. T. A. Herman is now asst chief engineer of the reciprocating engineering div.

OBITUARIES

Karl E. Saboe, until recently retail branch mgr at St. Louis for Iron Fireman Manufacturing Co., died of a heart attack.

Frederick L. Curtis, retired v-p of Raybestos-Manhattan, Inc. and former genl mgr of the Manhattan Rubber Div. died at his home in Passiac, N.J. He was 84 years old.

—End

♫ ZEIGLER ... It's a grand old name ♫

Ever since 1904, coal buyers have been singing the praises of ZEIGLER COAL. During the past 48 years millions of tons have been mined and shipped by rail and water to dealers and industrial plants throughout the middle west—indisputable testimony to its excellence. Through the years, this high grade coal has been mined, cleaned and processed by the newest methods. As fast as new devices and improvements in preparation methods were developed, they were adopted in the ZEIGLER plant. This policy has never varied, and today, after continuous progress, ZEIGLER still means the last word in coal production.

Among the famous *select* coals produced and distributed by Bell & Zoller Coal Company, ZEIGLER is truly a grand old name. Today, as for years past, GENUINE ZEIGLER SUPER-X, and SUPERWASHED ZEIGLER are prime favorites with selective users of coal.

Announcing new branch sales office:
TERRE HAUTE, INDIANA
Suite 517, Tribune Bldg. Phone Crawford 2974

BELL & ZOLLER COAL COMPANY

BELL BUILDING, CHICAGO 1, ILLINOIS
ST. LOUIS • NASHVILLE • OMAHA • MINNEAPOLIS
Sixty-Six Years of Service to Coal Users

Producers of
ZEIGLER, MOSS HILL, ORIOLE, MURDOCK, and BUCKHORN Coals

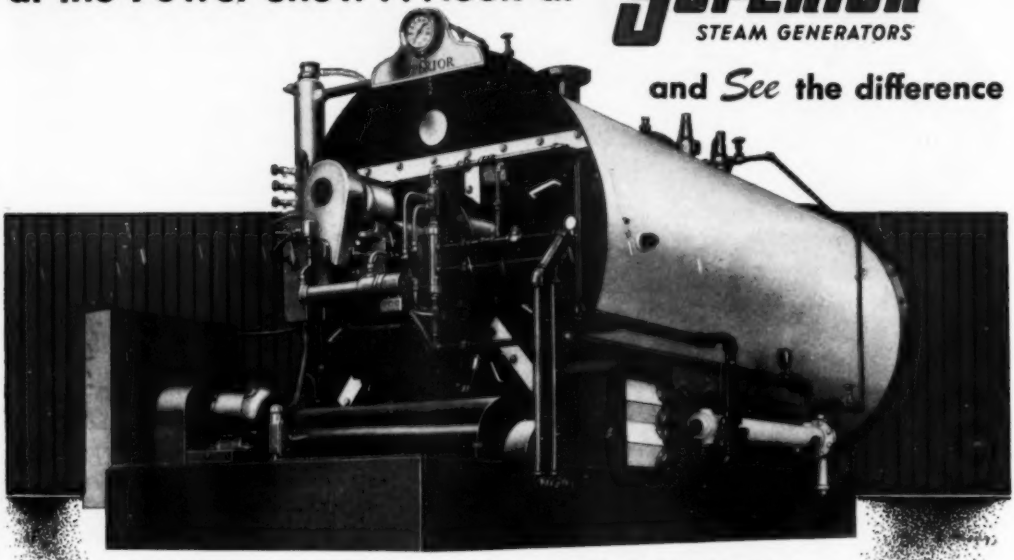
Sales Agents for
Mulberry Hill Coal Company
Freeburg, Illinois

Otter-Eagle Coal Company
Lockwood, West Virginia

Boone County Coal Corporation
Sharples, West Virginia

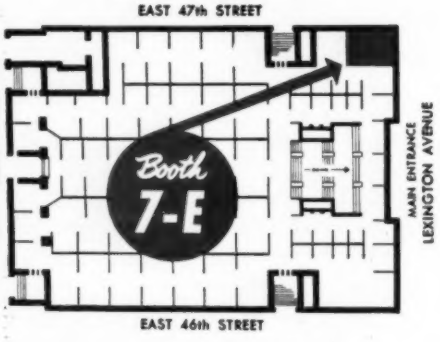
at the Power Show . . . look at SUPERIOR STEAM GENERATORS

and *See* the difference



HERE'S WHAT TO LOOK FOR:

POWER SHOW
DEC. 1st through DEC. 6th



GRAND CENTRAL PALACE
NEW YORK

Look . . . at Superior's 4-pass fire-tube design . . . ample heating surfaces with a minimum of 5 sq. ft. per b.h.p.

Look . . . at Superior's built-in multiple induced-draft fans . . . drawing evenly across the entire tube area, and eliminating the need for an expensive chimney.

Look . . . at Superior's Rotary Burner with its own fan supplying primary air . . . fully automatic with oil or gas, or both . . . change from either fuel to the other quickly, without dismantling equipment or interrupting steam supply.

Look . . . at Superior's safety features . . . induced draft which prevents the escape of combustion gases into the boiler room . . . fool-proof combustion gas pressure-relief port . . . constant gas pilot throughout gas firing periods . . . dual purging of all gas passages, both before and after firing.

Look . . . at the overall picture . . . a complete packaged steam plant. One purchase shipped completely assembled after factory test to assure dependable operation at a guaranteed thermal efficiency of more than 80%.

Look . . . at Superior's catalog for the complete story. If you're not going to the show, write for Catalog 402.

for performance you can **BANK** *on*

SUPERIOR STEAM GENERATORS

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

3 *special departments featured monthly to give you FREE bulletins, catalogs and product data screened for your personal interest in*

ENGINEERED PLANT SERVICES

1. NEW EQUIPMENT

Begins on page 8

Contains highlights of new products by leading manufacturers, briefed and illustrated for your easy reference. Complete data on each of these products are available ***free.***

2. NEW BULLETINS

Begins on page 164

Includes descriptions of only those bulletins and catalogs that are really ***new*** and of ***direct value*** to you — saves your reading time, yet gives you full service. All bulletins sent to you ***free*** on request.

3. READERS GUIDE TO ADVERTISED PRODUCTS

Begins on page 149

Designed to catalog advertised products for your convenience in finding the ads which are of special interest to you at this time. Also lists those important bulletins, catalogs and working data offered ***free*** in the advertisements.

REQUEST CARD FOR LITERATURE OR MORE INFORMATION—Nov., 1952

To: INDUSTRY AND POWER, St. Joseph, Mich. Please have forwarded to me, at no obligation, the literature I've indicated by the following key numbers:

New Equipment begins Page 8	*New Bulletins begins Page 164*	*Advertised Products begins Page 149*
No.'s	No.'s	No.'s

Your Name _____ **Title** _____

Your Company _____

Co. Address (St. & No.) _____

City _____ **State** _____

Inquiries for items listed in this issue not serviced beyond March 1, 1953

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(Sec. 34.9, P.L.&R.)
ST. JOSEPH, MICH.

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3 *special departments featured monthly to give you FREE bulletins, catalogs and product data screened for your personal interest in*

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Your Name _____ Title _____

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City _____ State _____

Inquiries for items in this issue not serviced beyond March 1, 1953

Readers' guide to advertised products

This department is both a product index for advertising and a keyed listing for advertised literature. Refer to advertisement on page indicated and contact advertiser directly—or list paragraph key numbers on reader service card (page 147) to get data you want

AIR & DUST FILTERS & COLLECTORS

Dust Collectors **500**
Cat 601 gives complete details on Aerotec Design 3 RAS dust collector. The Thermix Corp. p 126.

Dust Control Systems **501**
Literature available on Kirk & Blum dust control systems. The Kirk & Blum Mfg. Co. p 161.

Electrical Precipitators **502**
Bull FA contains data on Cottrell Precipitators. Research Corp. p 46.

Dust Collectors **503**
Bull 164-3 describes Norblo automatic bag type dust collection. The Northern Blower Co. p 62.

Precipitators **504**
Literature describes advantages of combination mechanical and electrical Multiclone-Cottrell Precipitator. Western Precipitation Corp. p 141.

ANTI-CORROSIVE & PROTECTIVE COATINGS

Rust Preventive **505**
Adv. p 61 contains coupon for complete information on Rust-Oleum sealing compound. Rust-Oleum Corp.

BOILERS & BOILER ACCESSORIES

Water Gages **506**
Bull 1051X describes Diamond water gages and water columns. Diamond Power Specialty Corp. p 115.

Liquid Level Indicators **507**
Bull WG-1823 or WG-1830 describes the Yarway indicator-recorder. Yarnall-Waring Co. p 55.

Chimneys
See adv. p 174 for information on chimneys. Consolidated Chimney Co.

Steam Generators **508**
Catalog VC-3 describes Erie City modern 2-drum steam generator. Erie City Iron Works. p 50.

Dual-Element Fuses **509**
Coupon in Adv. p 12-13 offers complete facts on Fusetron dual-element fuses. Bussmann Mfg. Co.

Vertical Unit Boilers
See adv. p 23 for information on C-E vertical unit boilers. Combustion Engineering-Superheater, Inc.

Boilers **510**
Cat 310 contains information on p-k heat reclaiming equipment, storage heaters and condensate coolers. The Patterson-Kelley Co., Inc. p 137.

BUILDING HEATING, VENTILATING, AIR CONDITIONING & REFRIGERATION

Air Handling Equipment
Information on heating, cooling, drying, air conditioning and air handling equipment. American Blower Corp. p 138.

Unit Heaters **511**
Bull DS-327A describes Trane line of unit heaters. The Trane Co. p 40.

BUILDING MATERIALS & MAINTENANCE

Metal Grating **512**
Free booklet "Instructions for Laying Klemp Hexsteel and Floorsteel". Klemp Metal Grating Corp. p 136.

Floor Patch **513**
Send coupon p 174 for complete details of trial order plan and Handbook of Building Maintenance. Flexrock Co.

Iron Cement **514**
Coupon on p 160 offers free repair handbook describing Smooth-On repairs. Smooth-On Mfg. Co.

Thread Compound **515**
Free sample and data sheet on Fel-Pro C-5 "Hi-Temp" thread compound. Felt Products Mfg. Co. p 174.

COAL, ASH & BULK HANDLING

Vibratory Equipment **516**
Free illustrated folder on electric vibrators and vibratory feeders for material handling. Syntron Co. p. 158.

Coal Handling Equipment **517**
Bull 300 contains data on 4 G-W basic designs of coal handling. Gifford-Wood Co. p 165.

(Continued on page 150)

PRODUCT INDEX

Air & Dust Filters & Collectors 149
Anti-Corrosive & Protective Coatings 149
Boilers & Boiler Accessories 149
Building Heating, Ventilating, Air Conditioning & Refrigeration 149
Building Materials & Maintenance 149
Coal, Ash & Bulk Handling 149
Compressors 150
Controls, Regulators & Instruments 150
Electrical Distribution 150
Electrical Heating Units 150
Engines 152
Fans & Blowers 152
Fuels & Firing Equipment 152
Heat Exchanger Equipment 152
Instruments for Measure of Electricity 153
Lubricants, Lubrication, Oil Filters & Purifiers 153
Mechanical Power Transmission 153
Packaged Steam Generators 154
Packing & Gaskets 154
Pipe, Tubing & Hose 156
Pumps 156
Refractory Concretes 157
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Water Treatment 159
Miscellaneous 159

Readers' guide to advertised products

(Continued from page 149)

Coal Handling Equipment 518
Book 2410 shows latest equipment and system layouts for power plants large and small. Link-Belt Co. p 3.

Coal Handling Equipment
Adv. p 123 describes complete line of crushers, pulverizers, shredders for reducing all classes of material to desired size. The Jeffrey Mfg. Co., Crusher Div.

Concrete Stave Silos 519
Full details on Marietta industrial storage systems and precast insulated concrete wall panels. The Marietta Concrete Corp. p 166.

COMPRESSORS

Compressors 520
Full information available on O-Ce compressors for continuous, heavy-duty operation. Chicago Pneumatic Tool Co. p 133.

Compressors 521
Bulletin contains complete data on Cooper-Bessemer power driven Type M compressors. The Cooper-Bessemer Corp. p 54.

CONTROLS, REGULATORS & INSTRUMENTS

Temperature Control
Information on complete line of temperature controls and regulators. The Powers Regulator Co. p 104.

Tank Gage 522
Details available on Liquidometer tank gage. The Liquidometer Corp. p 178.

Regulators 523
Bull 350 contains information on Spence pressure and temperature regulators. Spence Engineering Co., Inc. p 52.

Indicators and Recorders 524
Free booklet contains data on Ranarex indicators and recorders. The Permutit Co. p 170.

Regulators 525
Adv. p 159 contains information on boiler feed regulators. For details consult Sweet's Catalog or write to company. Henszey Co.

Pressure Controls 526
Adv. p 179 offers Cat 700A on automatic control problems. The Mercoid Corp.

Regulators 527
Adv. p 167 offers illustrated bulletins on various types of regulators. Leslie Co.

★ SIMPLIFIED RING CUTTING — Super Seal can easily be pulled down to any shaft or stem size.

★ POSITIVE PACKING IDENTIFICATION — Super Seal styles are clearly marked, each one in a different color.

For many years, SUPER SEAL No. 3 has been achieving outstanding service records in valves and centrifugal pumps handling oils, solvents and petroleum distillates on refinery applications. It is highly recommended for temperatures to 550° F.

Now, with patented "tape-back" construction, SUPER SEAL is easier to use, easier to identify. It's another special "John Crane" feature to insure perfect packing satisfaction.

It's hard to believe the resilience of "tape-back" SUPER SEAL until you twist it down yourself. Send for a sample and try it.

JOHN CRANE
CRANE PACKING COMPANY
1831 CUTLER AVENUE • CHICAGO 13, ILLINOIS
Offices in All Principal Cities in United States and Canada

HOW TO REQUEST FREE LITERATURE

Insert "key" numbers on return post card found on page 147. For quick reference to free literature offered by advertisers in this issue, refer to listing on page 160. Our Reader's Service Department will handle your request promptly.

ELECTRICAL DISTRIBUTION

Electrical Conduit 528
Bull C-201 describes Sealtite flexible electrical conduit. The American Brass Co., American Metal Hose Branch. p 27.

Circuit Breakers 529
Cat Sec 1003 contains selection and application data on I-T-E large air circuit breakers. I-T-E Circuit Breaker Co. p 18-19.

Fuses 530
Price list and catalog on "Economy De-Lay" Renewable Fuses. Economy Fuse and Mfg. Co. p 42.

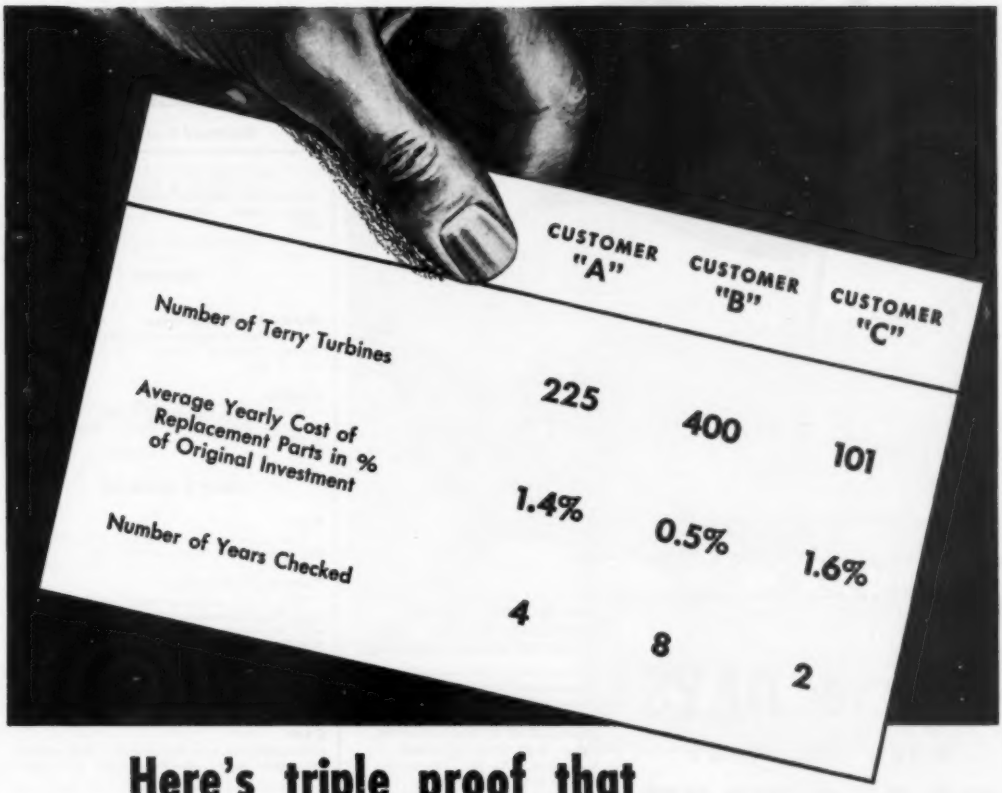
Interlocked Armor Cable 531
Cat. "G-E Interlocked Armor Cable," Pub. No. 19-211 contains complete facts. General Electric Co., Construction Materials Div. p 108.

Capacitors 532
Booklet GEA-5632, "How to Use Capacitors to Reduce Power Costs and Gain System Capacity." General Electric Co., Motors & Appar. Div. p 34.

ELECTRICAL HEATING UNITS

Electric Heaters 533
Catalog 50 describes many types of

(Continued on page 152)



Here's triple proof that
IT PAYS TO SPECIFY TERRY TURBINES

When you combine the figures for these three customers — a total of 726 turbines — the average yearly cost of replacement parts works out to only 1.1% of the original investment. A truly remarkable record, even when you realize that they are Terry turbines.

But, the cost of replacement parts is only the beginning of the story. The real savings are in the labor costs and production losses which are reduced so drastically when you install Terry turbines.

Send for further information about these low-maintenance turbines. Bulletin S-116 describes the many advantages of the Terry solid-wheel turbine. For multistage turbines, ask for a copy of Bulletin S-146.

THE TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.

SAVES YOU DAYS

WHEN YOU WANT

TOOLS FAST

When you need hand and bench tools *now*, delivery next month won't help much! To give you service *now*—as well as to help you with your year-around tool problems—Snap-on's 42 factory branch warehouses listed here put a selection of more than 4,000 tools at your elbow. The Snap-on branch near you is staffed with tool specialists—men who know how to help you save production and maintenance time and increase safety by using the right tools. Let us send you copies of the latest Snap-on Industrial and General Catalogs.

SNAP-ON SERVES INDUSTRY EVERYWHERE THROUGH THESE 42 FACTORY BRANCH WAREHOUSES

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Boston 35, Mass., 116 N. Beacon St.
Brooklyn 25, N. Y., 1649 Bedford Ave.
Buffalo 13, N. Y., 628 W. Utica St.
Charlotte 6, N. C., 915 S. Clarkson St.
Chicago 7, Ill., 120 N. May
Cincinnati 6, Ohio, 605 E. McMillan St.
Cleveland 15, Ohio, 2912 Euclid Ave.
Dallas 1, Texas, 2932 Commerce St.
Denver 3, Colo., 1050 Broadway
Detroit 2, Mich., 93 Piquette Ave.
Fargo, N. Dak., 421 N. P. Ave.
Houston 3, Texas, 1810 LaBranch St.
Indianapolis 2, Ind., 848 Fort Wayne Ave.
Jacksonville 6, Fla., 1602 Walnut St.
Kansas City 2, Mo., 3635 Main St.
Los Angeles 14, Calif., 1717 W. 6th St.
Milwaukee 3, Wis., 2600 W. State St.
Minneapolis 3, Minn., 1218 Harmon Place
Newark 6, N. J., 823 Sandford Ave.
New Orleans 13, La., 1040 Camp St.
New York 67, N.Y., 2807 White Plains Rd.
Oklahoma City 3, Okla., 901 N. Hudson
Omaha 2, Nebr., 109 S. 24th St.
Philadelphia 30, Pa., 1710 Fairmount Ave.
Pittsburgh 8, Pa., 7007 Kelly St.
Richmond 20, Va., 1617 West Broad St.
San Francisco 2, Calif., 635 Golden Gate
Seattle 22, Wash., 1501 Olive Way
St. Louis 3, Mo., 2647 Washington Blvd.
Syracuse 3, N. Y., 323 Irving Ave.
Toledo 6, Ohio, 2932 Monroe St.

IN CANADA

Edmonton, Alberta, 10232 103rd St.
London, Ontario, 111 Mt. Pleasant Ave.
Moncton, N. B., 27 Pearl St.
Montreal 15, Que., 751 Jean Talon St. W.
Regina, Sask., 2070 Albert St.
Toronto 17, Ont., 130 Laird Drive
Vancouver, B. C., 1043 Davie St.
Winnipeg, Manitoba, 238 Gerry St.

SNAP-ON TOOLS CORPORATION
8102-K 28th Ave., Kenosha, Wis.

Readers' guide to advertised products

(Continued from page 150)

Chromalox electric heaters and how to apply them. Edwin L. Wiegand Co. p 143.

ENGINES

Supair-Thermal Engine **534**
Bull 191 contains full details on the Supair-Thermal engine. Nordberg Mfg. Co. p 109.

Engines
Information on Worthington dual fuel engines. Worthington Corp., Engine Div. p 127.

FANS & BLOWERS

Fans
Adv. p 4 contains information on Clarage fan equipment. Clarage Fan Co.

Centrifugal Blowers **535**
Bull A-650 contains data on multistage centrifugal blowers. Bulletins on stationary and portable industrial vacuum cleaning equipment also offered. U. S. Hoffman Machinery Corp. p 124.

FUELS & FIRING EQUIPMENT

Coal
Information on Southern's engineered industrial coal. Southern Coal Co., Inc. p 49.

Coals
Information on Bell & Zoller coals. Bell & Zoller Coal Co. p 145.

Coal & Ash Handling Equipment
Adv. p 180 contains data on Canton coal firing, handling, and control equipment. Canton Stoker Corp.

Burners
Adv. p 139 contains data on John Zink Series YC combination gas and oil burner and ST gas burner. John Zink Co.

Coal
See adv. p 47 for information on Beacon coal. Eastern Gas & Fuel Assoc.

Coal
Adv. p 63 contains information on bituminous coal. Bituminous Coal Institute.

HEAT EXCHANGER EQUIPMENT

Water Heater **536**
Coupon p 132 offers literature on the Coe safety water heater. The Coe Mfg. Co.

Deaerators
Adv. p 129 contains information on Worthington deaerators. Worthington Steam Power Div.

Film Type Exchangers **537**
Bull HE-7 describes typical installations of Vogt film type exchangers. Henry Vogt Machine Co. p 48.

(Continued on page 153)

INSTRUMENTS FOR MEASURE OF ELECTRICITY

Testing Instruments

See adv. p 24-25 that describe G-E testing instruments for trouble shooting. General Electric Co.

LUBRICANTS, LUBRICATION, OIL FILTERS & PURIFIERS

Non-Fluid Oil **538**

Bull 504 and free testing sample of Non-Fluid oil. New York & New Jersey Lubricant Co. p 154.

Lubricants

Adv. p 168 contains information on Albany lubricating products. Adam Cook's Sons, Inc.

Oil Filters

Adv. p 178 contains data on Winslow oil filters. Winslow Engineering Co.

Diesel Lubrication

Adv. p 16-17 contains data on Gascon oil for diesel lubrication. Sinclair Refining Co.

Turbine Oil

Adv. p 51 contains information on Nonpareil turbine oil. Standard Oil Co.

Lubricant

See adv. p 182 for information on Texaco Regal oils. The Texas Co.

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MECHANICAL POWER TRANSMISSION

V-Belts

Features of Manhattan's endless flat belts described on p 119. Raybestos-Manhattan, Inc. Manhattan Rubber Div.

Universal Joints **539**

Descriptive literature available on Lovejoy Universal joints. Lovejoy Flexible Coupling Co. p 156.

QD Sheaves **540**

Bull V-1400-B7F contains data on Worthington multi-V-drives. Worthington Corp., Multi-V-Drive Sales Div. p 125.

Grommet V-Belts

Adv. p 35-36-37-38 discuss Goodrich grommet belts. The B. F. Goodrich Co., Industrial Products Div.

V-Belts

Information on Gates Vulco Ropes. The Gates Rubber Co. p 37.

Chains **541**

Data on Atlas "Super-Life" Roller Chain offered in new catalog and handbook. Atlas Chain & Mfg. Co. p 131.

(Continued on page 154)

Steam-Pak Generators Make a Showroom of Your Boiler Room

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Readers' guide to advertised products

(Continued from page 153)

PACKAGED STEAM GENERATORS

Package Steam Generator **542**
Coupon p 21 offers free folder "All Your Questions Are Answered by Cyclotherm." Cyclotherm Div., U. S. Radiator Corp.

Amesteam Generator **543**
Bull 1050 contains data on the Amesteam generator. Ames Iron Works. p 114.

Steam Generators **544**
Coupon p 142 offers catalog on Clayton forced recirculation steam generators. Clayton Mfg. Co.

Self-Contained Generators **545**
Bull 201 gives installation and operating advantages of York-Shipley Steam-Pak generators. York-Shipley, Inc. p 153.

Packaged Boilers **546**
Bull 1218 contains data on Powermaster packaged automatic boilers. Orr & Sembower, Inc. p 111.

Packaged Steam Boilers **547**
Illustrated and descriptive Cleaver-Brooks steam boiler catalog available. Cleaver-Brooks Co. p 43.

Packaged Automatic Boilers **548**
Full details available on Continental packaged automatic boilers. Boiler Engineering & Supply Co. p 175.

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Boiler-Burner Unit **549**
14-page catalog describes boiler—(by Kewanee) burner (by Iron Fireman) unit. Iron Fireman Mfg. Co. Kewanee-Ross Corp. p 121.

Steam Generator
See adv. p 30 on cutting steam costs in boiler and board rooms. Offers invitation to visit booth at Power Show. Preferred Utilities Mfg. Corp.

Steam Generator **550**
Adv. p 146 offers Cat 402 on complete story of Superior steam generator. Also invitation to visit booth 7-E at Power Show. Superior Combustion Industries Inc.

PACKING AND GASKETS

Gaskets **551**
Catalog contains data on Spiralwound gaskets. United States Gasket Co. p 173.

(Continued on page 156)

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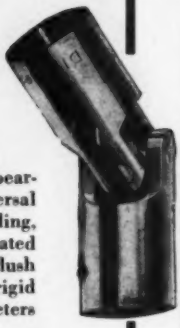

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Readers' guide to advertised products

(Continued from page 154)

Packings **552**
Catalog contains data on R/M packings and gaskets. Raybestos-Manhattan, Inc., Packing Div. p 155.

Packings **553**
6-page guide, "Johns-Manville Packings for the Power Plant" available. Johns-Manville Corp. p 60.

Packing
See adv. p 28-29 for data on industrial packing. Announcement is made of the addition of Gilmer V-belts and other products. New York Belting & Packing Co.

Packings
See adv. p 150 for data on Crane Super Seal packing. Crane Packing Co.

Packings **554**
20-page Palmetto Packings catalog PC-102 contains data covering all maintenance needs. Greene, Tweed & Co. p 150.

PIPE, TUBING & HOSE

Flexible Metal Hose **555**
Cat 500 contains data on seamless & interlocking hose in bronze, steel & stainless steel. Atlantic Metal Hose Co. p 175.

Pipe Unions
Adv. p 171 contains information on Dart Unions. Dart Union Company.

Insulated Piping **556**
Literature available on Ric-wiL prefabricated insulated piping. The Ric-wiL Co. p 144.

Piping Layouts **557**
Piping Layout No. 63 contains detailed information. Jenkins Bros. p 9.

Pipe Fittings
Information on complete line of malleable iron and cast iron pipe fittings. Grinnell Co., Inc. p 107.

PUMPS

Pumps **558**
Complete details available on Marlow pumps. Marlow Pumps. p 128.

Pumping Problems
See adv. p 113 for data on pump engineering assistance. Byron Jackson Co.

Controlled Volume Pumps
Information on Milton Roy controlled volume pumps for boiler water treatment. Milton Roy Co. p 53.

Chemical Proportioning Pump **559**
Bull 1923 contains data on %Proportioneers% Micro-Shot for proportionate pumping of chemical solutions. %Proportioneers, Inc.% p 118.

Fire Pumps **560**
Bulls. B-1500 and B-152 describe Peerless horizontal and vertical turbine fire pumps.

Peerless Pump Div., Food Machy. & Chemical Corp. p 39.

REFRACTORY CONCRETES

Refractory Cement **561**
Coupon offers catalog and prices on Super 3000 refractory cement. Refractory & Insulation Corp. p 140.

Refractories
Adv. p 103 gives information on Kaocast refractories. Babcock & Wilcox Co., Refractories Div.

Industrial Concrete
Adv. p 38 contains information on Lumnite for industrial concretes. Lumnite Div., Universal Atlas Cement Co.

SOOT BLOWERS & TUBE CLEANERS

Tube Cleaners **562**
Information available on Airetool tube cleaners. Airetool Mfg. Co. p 137.

STEAM SPECIALTIES

Traps **563**
Catalog 731 (or see Sweet's) contains data on Nicholson weight-operated traps. W. H. Nicholson & Co. p 163.

Impulse Steam Traps **564**
24-page catalog contains data on Yarway traps and strainers. Yarnall-Waring Co. p 64.

Steam Traps **565**
Steam Trap Book gives advantages of Armstrong unit trapping. Armstrong Machine Works. p 2.

Steam Traps **566**
Bull 250-14 describes Sarco balanced pressure thermostatic steam traps. Sarco Co., Inc. p 181.

Snap-On Tools **567**
Industrial and general catalog of 4,000 hand and bench tools. Snap-On Tools Corp. p 152.

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THERMAL INSULATION

Aluminum Jacketing **568**
Samples and full details available on Childers aluminum weather-proof jacketing. Childers Mfg. Co. p 50.

TOOLS

Pipe Tools **569**
Adv. p 169 describes Toledo Simpact for all 1" to 3" threading. Toledo Pipe Threading Co.

Proto Tools **570**
Send 10c for 68-page catalog of Proto tools. Plomb Tool Co. p 6.

(Continued on page 158)

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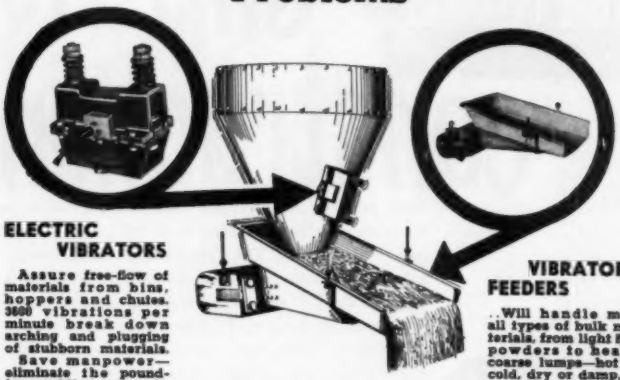

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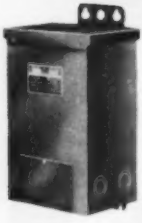

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Readers' guide to advertised products

(Continued from page 157)

Handhole Seat Grinder **571**
Bull Y-22 contains full details on Elliott handhole seat grinder. Elliott Co., Lagonda Div. p 122.

TRANSFORMERS

Transformers **572**
Catalog contains full data on Magna Tran dry type transformers. Magnatran Inc. p 158.

Transformers **573**
Bulls 183 and 186 describe Acme electric dry type air cooled transformers. Acme Electric Corp. p 179.

TURBINES

Turbines **574**
Bull S-116 describes Terry solid-wheel turbine. Bull S-146 describes multistage turbines. The Terry Steam Turbine Co. p 151.

Turbines **575**
Book B-3896 describes Westinghouse Type E turbines. Westinghouse Electric Corp. p 33.

Turbines **576**
Bull 135 contains data on Coppus turbines from 150 hp to smallest size. Coppus Engineering Corp. p 45.

Turbines
See adv. p 112 for table on operating ranges and specifications of steam turbines. L. J. Wing Mfg. Co.

VALVES

Regulating Valves **578**
Coupon p 172 lists Bull 1-A on regulating valves; also other products. Atlas Valve Co.

Pump Valves **579**
Catalog gives 4 ways to cut pump repairs. Sims Pump Valve Co., Inc. p 176.

Butterfly Valves **580**
Valve catalog contains data on Rockwell butterfly valves. W. S. Rockwell Co. p 154.

Valves
See adv. p 130 for invitation to Power Show. Your attention is called to Booths 46 and 47. The Chapman Valve Mfg. Co.

Valves
Adv. p 116-117 contains data on instrument valves and pressure seal valves. Edward Valves, Inc.

Regulating Valves
Adv. p 134 contains data on Clark pressure reducing & regulating valves. The Clark Mfg. Co.

Valves
See adv. p 7 for information on Crane iron body swing check valves. Crane Co.

WATER TREATMENT

Water Treatment **581**

Free copy "This is Nalco" contains data on how to solve water treating problems. National Aluminate Corp. p 11.

Water Treatment Plants **582**

Bulletins available on manual and automatic water treatment plants. Hungerford & Terry, Inc., p 160.

Amine Treatment **583**

Bull CP 100 contains all facts on amine treatment. The Bird-Archer Co. p 44.

Water Treating Equipment **584**

Bull 1845 contains complete information on JBAS water treating equipment. Infilco Inc. p 56.

Return Line Corrosion **585**

Bull 5013 outlines causes of return line corrosion and describes its control. Dearborn Chemical Co. p 135.

Water Treatment **586**

See adv. p 41 for bulletins offered in the water treatment field. Allis-Chalmers Mfg. Co.

Water Conditioning Service **587**

Technical Paper No. 115 contains complete story on carryover and blowdown control with anti-foam agents. W. H. & L. D. Betz. p 15.

MISCELLANEOUS

Engineers, Constructors

See adv. p 120 for data on design and construction in modern expansion projects. The Kuljian Corp.

—End

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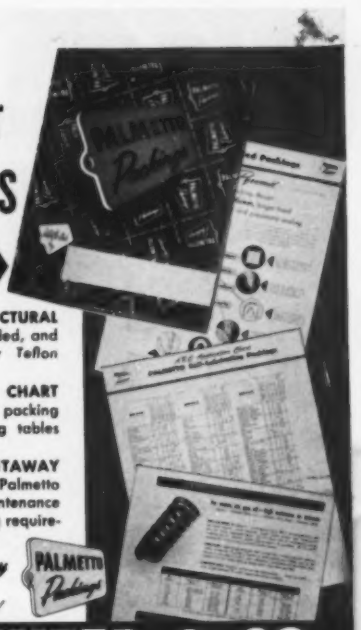

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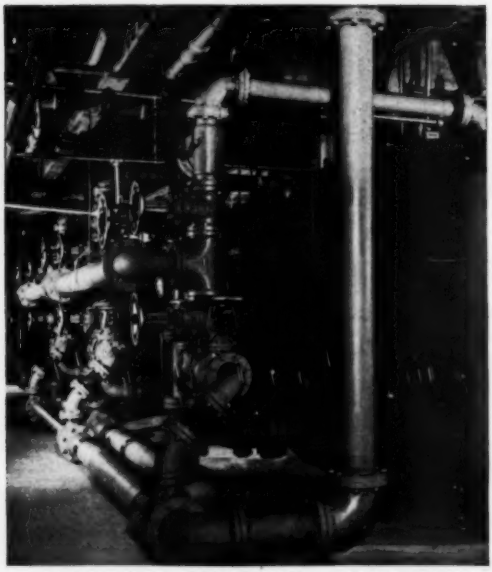

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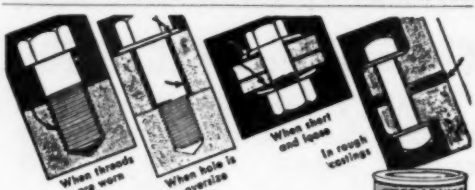

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20 collector KIRK AND BLUM DUST CONTROL SYSTEM

removes 99.5% of dust at FORMICA

A good indication of the efficiency of KIRK & BLUM Dust Control Systems on dust particles of any size is given by a recent installation where small particles are the principle dust load.

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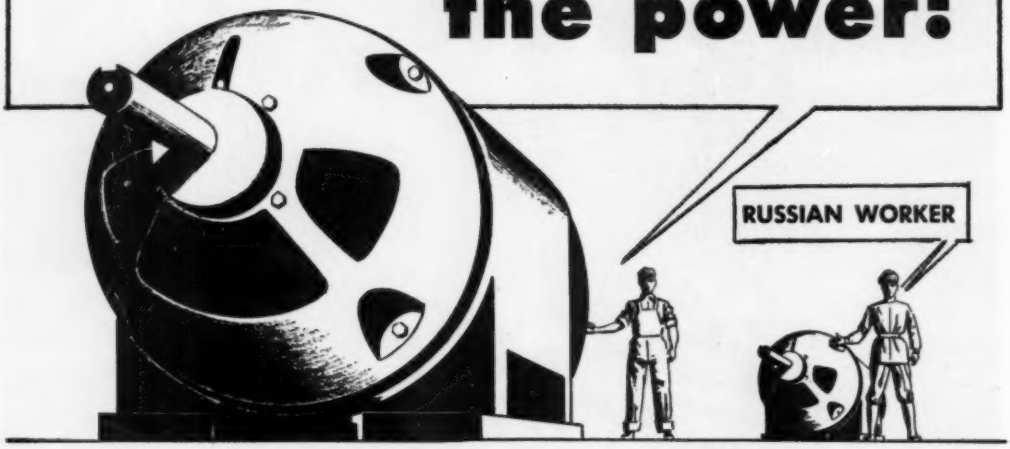

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Why does the American worker have the help of about 7 times as many kilowatt-hours of electric power as is available to the Russian worker?

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The answers cannot be laughed off nor are they hard to find. In the words of Ralph J. Cordiner, president of the General Electric Company: "The greatest impetus for forward movement still comes when individuals are free to plan and carry out their own ideas without government coercion or unnecessary regulation."

Including estimated expenditures in 1952, private industry in the last seven years will have invested over 150 billion dollars in new plant and equipment. This contrasts with Federal Government investment of not much more than 12 billion for similar purposes in the same period. Moreover most such Government expenses during the last three years have been allocated to military and atomic projects.

Back of all this progress in private industry is the unique American system of competition—our kind of competition that continually stimulates Americans to make things better and to sell them better—and at lower prices.

In America we do not just compete for public office; we also compete in technology, competency of management, individual initiative and distribution—the latter including selling and advertising in all their varied forms.

Our kind of competition promotes the growth of more and more businesses and industries—and this means more jobs and expanding prosperity from which we all benefit.

"Planned economies" and other fancy theories are not for us. The American competitive system has given us the highest standard of living in the world. Let's all work to preserve it.

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THE COMPETITIVE SYSTEM DELIVERS THE MOST TO THE GREATEST NUMBER OF PEOPLE

Reviews of recent books . . .

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Mathematical Analysis

"Nomography and Empirical Equations," by Lee H. Johnson, Dean of Engineering, Tulane University. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 150 pages, illustrated with graphs, charts and problems. Price $3.75.

The author presents his conception of the simplest and most direct approach to the use of nomographs and empirical equations for recording and analyzing operational and experimental data, which are constantly being observed and recorded in business, industry, professional practice and research. These data are required for the development of new techniques and equipment as well as for analysis and control of current operations. Therefore, a good working knowledge of the two time saving techniques is especially useful.

A method of analyzing an equation and its variables before plotting in nomographic form is introduced for the first time. Another innovation is a discussion of the effect of scale arrangement on the accuracy of a nomograph. The book shows how to apply nomography and curve fitting to a wide variety of problems in science and engineering, and how to save time by providing a simple graphical solution.

Heating, Ventilating, Air Conditioning

"Heating Ventilating Air Conditioning Guide for 1952" published by The American Society of Heating and Ventilating Engineers, 62 Worth Street, New York 13, N. Y. 1465 pages containing illustrations, drawings, charts and tables. Price $7.50.

This is the 30th edition of the Guide which serves not only the membership but the entire profession as a factual and authoritative hand book. Its contents have been carefully edited to provide reliable information on modern equipment within its area. The Technical Data Section alone contains 1064 pages of technical and design information on 50 different subjects.

The chapter arrangement is the same as in the last two editions, the material being grouped under the familiar section titles: I Fundamentals, II Human Reactions, III Heating and Cooling Loads, IV Combustion and Consumption of Fuels, V Systems and Equipment, VI Special Systems, VII Instruments and Codes. The entire book has been reviewed and important changes made. Special attention is called to revisions in the following chapters:

Chap. 9—Heat Transmission Coefficients of Building Materials. Water vapor and building construction condensation has been rewritten and enlarged to more fully bring out visible and concealed condensation and preventive methods. New materials are listed in the conductivities and conductances tables. Chap. 11—Heating Load. The U.S. Weather Bureau and Canadian Meteorological Service provided average winter temperatures Oct. to May for 316 U.S. and 16 Canadian cities. Chap. 12—Cooling Load. Simplified tables for flat and block glass with the addition of design tables for rolled glass. Chap. 32—Fans. Applications of fans for high temperatures have been added. Fan nomenclature and designations now conform with current industry practice.

Also included is a Catalog Data Section which gives names, addresses and product descriptions for 277 manufacturers—together with a cross index.

Instrumentation

"Instrumentation for the Iron & Steel Industry". Available from the Instruments Publishing Co., Inc., 921 Ridge Ave., Pittsburgh 12, Pa. 48 pages illustrated with photographs, diagrams, and curves. Price $2.00.

This is the proceedings of the First Annual Conference on Instrumentation for the Iron and Steel Industry. Included are eleven papers on a variety of subjects such as measurement and control of furnace fuel; gaging; electronic, hydrau'ic and pneumatic controls; x-ray inspect'on; metal sorting; temperature measurements of molten metals; and welding instrumentation.

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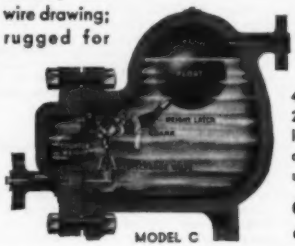
Even though re-evaporation completely dries up its body, a Nicholson weight-operated trap will not leak live steam. Its valve is raised by counterweight, not by buoyancy of float. Other features: large orifices keep valve clean; non-wire drawing; rugged for unavoidable abuse; not easily affected by dirt, pulsation; of stainless steel where it counts. Widely used for steam purifiers, super-heated steam lines, headers, separators, heaters, dry kilns, pipe coils, turbine throttle valve drips, stop and check valves, etc. Also for air and gasoline.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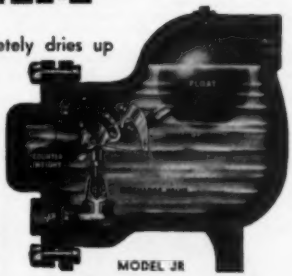
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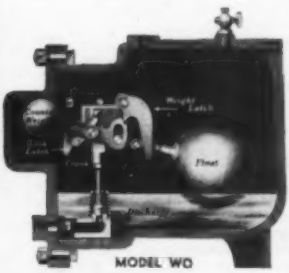
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AIR & DUST FILTERS & COLLECTORS

Cloth Type Filter **200**

Designed primarily for continuous process industries, a new cloth screen dust filter described in 8-page bulletin 102 is said to provide uniform suction at all dust points. How it works, application to existing systems, advantages and specifications are presented. A section entitled "How to Engineer a Dust Problem" presents information that should be of interest. The W. W. Sly Manufacturing Co.

Cloth Type Filters **201**

Tubular cloth type dust filters are the subject of 12-page bulletin 24-D. Advantages and applications of both vacuum and pressure type filters are discussed. Details of construction and the design of component parts are outlined. Tables of capacity and dimensions also are included. Ruemelin Mfg. Co.

ANTI-CORROSIVE & PROTECTIVE COATINGS

Wire Fence Maintenance **202**

Photos contained in industrial folder 120 tell the story of a recently developed roller method for coating wire fences. Advantages of this system are outlined. Rust-Oleum Corp.

BUILDING MATERIALS & MAINTENANCE

Floor Patch **203**

Holes, ruts, breaks and pitted areas in concrete floors can be repaired by an immediate setting floor patch described in a 4-page folder. Technical data on the product is presented. Flexrock Co.

Building Maintenance **204**

"Over the Rough Spots," 48-page manual, is published as a guide to practical, economical building maintenance. It tells how to patch holes or resurface any type of floor as well as how to solve water seepage in underground foundations, repair leaky roofs, preserve concrete or wood surfaces, protect structural steel, and many other maintenance problems. Stonhard Co.

CONTROLS, REGULATORS & INSTRUMENTS

Electronic Controls **206**

Electronic instruments for automatic control of process variables are the subject of 6-page folder A-702. Included is information on principles of operation, design, specifications, applications and installation. A second folder, A-705, describes manual controls for remote operation of final control elements, to be used with the control system. The Swartwout Co.

Electronic Governors **207**

Principles of operation of an electronic governor for prime movers are discussed in a 4-page folder. Heart of the system is a small centrifugal governor which is sensitive to speed variations of about .01 to .02 percent of maximum, according to the literature. W. C. Robinette Co.

Controllers & Pilots **208**

Discussed in catalog section 110 are various types of time cycle, pressure and manual remote controllers together with vacuum and safety shut-off pilots. This edition has been revised to show a recently developed pressure controller and a new safety shut-off pilot. Black, Sivalls & Bryson, Inc.

Coating Measurements **209**

Thickness of non-magnetic coatings on magnetic bases can be measured, and pinholes in non-conductive coatings on conductive bases can be detected with an instrument described in a 6-page folder. What it is, how it works, how to operate and general information is discussed. Branson Instruments, Inc.

pH Meters **205**

Every industry can utilize some form of pH control to increase operating efficiency, reduce waste and improve product quality, according to 28-page brochure 86-J. Published to guide the engineer in selecting the proper meter, it discusses the advantages, operation and applications of four types of instruments. Included is a portable meter for use in the field and an automatic unit for indicating, recording and controlling pH in processing operations. Various types of electrodes are described together with applications of each. Accessories and replacements also are presented. Beckman Instruments, Inc.

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Explosive Gas Detectors **210**

Four types of combustible gas protective instruments are catalogued in 4-page folder FSE1251. Included are a portable indicator, a portable audible alarm and two types of alarms for fixed locations. Principles of operation are discussed and specifications are tabulated. Johnson-Williams, Ltd.

Control Valves **211**

"New Techniques in Control Valve Design," 16-page technical paper 108, presents a review of the development of conventional control valves and predicts future designs. Outlined are the reasons for present designs and the logic behind those predicted. Photos and drawings supplement the text. Conoflow Corp.

COAL, ASH & BULK HANDLING

Belt Lacing **212**

Long length conveyer belt lacing is described in 2-page catalog sheet A-70. Advantages and typical applications are presented and sizes are listed. Flexible Steel Lacing Co.

(Continued on page 166)

BRINGING YOUR
COAL HANDLING COSTS

Down to Earth

Concrete Silo Storage with live storage shell, track hopper, double-chain bar feeder, centrifugal discharge bucket elevator, scale and monorail bucket.

Tile Silo Storage with track hopper, bar feeder, bucket elevator, 2000 lb. weigh larry.

Cylindrical Steel Tank Storage with feeder and conveyor.

Suspended Steel Bunker Storage showing bunker and weigh larry.

When coal handling costs are too high for comfort, remember Gifford-Wood's 4-basic design story. Each of these storage designs—concrete silo, tile silo, cylindrical steel tank and suspended steel bunker—are carefully engineered to meet specific limitations of climate, capacity, space available and cost. The combination of extensive engineering experience and well known manufacturing ability assures installations of highest possible operating efficiency at reasonable cost.

A Gifford-Wood engineer, thoroughly familiar with coal handling problems, is at your service. Let him study your needs and recommend a G-W system that will both simplify the operation and reduce your costs.

4

BASIC G-W WAYS TO CUT COAL HANDLING COSTS

1. Reinforced Concrete Silo Storage
2. Vitrified Tile Silo Storage
3. Cylindrical Steel Tank Storage
4. Suspended Steel Bunker Storage

Bulletin No. 300 describes, with illustration and working drawing, these 4 basic G-W types of handling systems. Write today for your copy.

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Marietta Concrete Wall Panels save 30% of new building costs

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New bulletins and catalogs

(Continued from page 164)

Conveyor Belting **213**

Case histories and performance data reports on numerous rubber products, including belting, hose and packings, are presented in a booklet, "Productioneered for Greater Output." V-belts, conveyer and flat transmission belts are dealt with. Types of hose include products for air, steam, water, welding, suction, chemical and fire protection. Quaker Rubber Corp.

Feeders & Rotary Valves **214**

Roll feeders for dry pulverized materials, vane type feeders for pulverized and granular materials, totally enclosed feeders with circular or rectangular flanges and rotary valves are described in 8-page catalog F-4. Capacities and specifications are tabulated. Fuller Co.

Pneumatic Systems **215**

General considerations in designing ash and dust handling systems for steam plants are outlined in 8-page brochure 652. A schematic drawing of a pneumatic system and concise descriptions of component parts are included. The Allen-Sherman-Hoff Co.

HOW TO REQUEST FREE BULLETINS

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CRANES, HOISTS & CAR PULLERS

Crane Equipment **216**

"Electrical Equipment for Cranes," 32-page booklet C5-1, describes such equipment as a-c and d-c motors, various types of brakes, controls and control panels, contactors, resistors, limit switches and collectors. Curves are used to show electrical characteristics. Harnischfeger Corp.

DIESELS

Diesel Units **217**

Series of 12 specification sheets 206-219, describe one, two and three cylinder diesel engines in the 10 to 45 hp range—1200 to 1800 rpm. Units described include diesel generator unit, engine with stub shaft, engine with clutch power take-off and pump unit for each type of engine. Nordberg Manufacturing Co.

BUILDING HEATING, VENTILATING & AIR CONDITIONING & REFRIGERATION

Unit Heaters **218**

Engineering data concerning selection and application of vertical and horizontal shaft unit heaters are tabulated in 48-page booklet 3570. Descriptions and applications of both types of heaters are given. Included is a section on motor controls showing typical wiring diagrams, and a section presenting piping illustrations and suggestions for both steam and hot water. Herman Nelson Div., American Air Filter Co., Inc.

Unit Heaters **219**

Horizontal and vertical propeller fan type unit heaters, for operation with steam or hot water, are the subject of 20-page booklet 3322. How they are used and how they operate is discussed. Design, construction, advantages and specifications are presented. Tables list capacities from 25,000 to 600,000 Btu per hr. A variety of diffuser accessories also are described. American Air Filter Co., Inc., Herman Nelson Div.

Unit Heaters **220**

Independent direct fired heating units are the subject of 8-page bulletin GNC. Oil, gas or combination oil-gas burners can be supplied. Advantages and typical applications are discussed. Construction is shown in a cutaway view. Specifications and dimensions are listed for models with output from 100,000 to 2,000,000 Btu per hr. Portable units as well as floor mounted and suspended types are shown. Prat-Daniel Corp., Thermobloc Div.

ELECTRICAL DISTRIBUTION

Circuit Breakers **221**

"How Much Can a Breaker Take?", 8-page reprint 71R7855, describes results of recent field tests conducted on a standard 69 kv, 1500 mva oil circuit breaker. Photos, drawings, diagrams and data tables supplement the text. Allis-Chalmers Manufacturing Co.

Voltage Stabilizers **222**

How to get stable voltage is discussed in 12-page bulletin GEA-5754. Operating principles, specifications and construction of single phase, automatic stabilizers from 15 to 5000 va are described. Also listed are causes and effects of voltage variations and typical applications for stabilizers. General Electric Co.

Light Dimming Equipment **223**

Light dimming equipment, available as packaged assemblies, is the subject of 12-page bulletin D651P. Described are units for different numbers of circuits requiring up to 2000 w each, and for various types of a-c operation. Wiring diagrams are included. The Superior Electric Co.

Aluminum Wire **224**

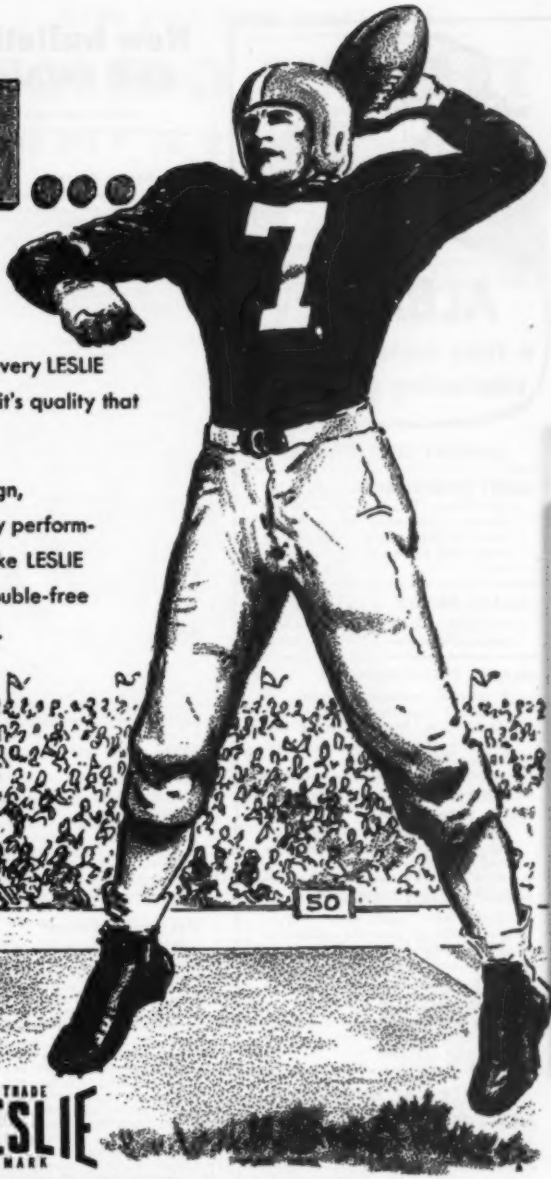
To answer the need for accurate information about aluminum electrical wire and cable, the National Electric Contractors Assn. has published an 8-page article, "Report on Aluminum Electrical Conductor." It points out problems involved when using aluminum conductors, and their solutions. Factors governing the choice of aluminum or copper for wire, cable and bus also are listed. The Thomas & Betts Co.

Magnetic Amplifiers **225**

Magnetic amplifiers are assuming an important role in systems which require reliable, static power amplification, according to 16-page bulletin TD-52-600. A definition of magnetic amplifier terminology is given, followed by an explanation of the theory of operation. Curves, tables and wiring diagrams deal with component parts, applications and operating characteristics for various types of magnetic amplifiers. Westinghouse Electric Corp.

(Continued on page 168)

Dependable Control...



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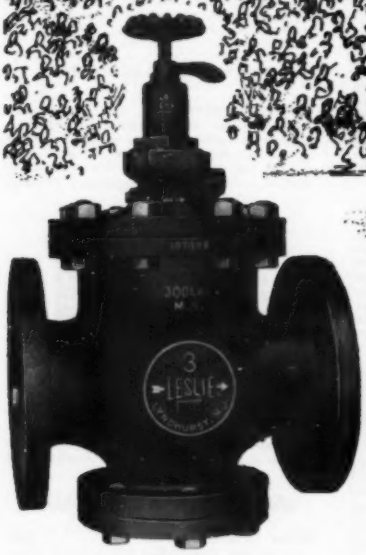
The fundamental principles of quality design, quality materials, quality manufacture, quality performance and quality service all combine to make LESLIE a logical choice for long-lasting, accurate, trouble-free pressure, temperature, or liquid level control.



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DIAPHRAGM CONTROL VALVES	—For use with instrument controllers.
TEMPERATURE REGULATORS	—For process heating or cooling.
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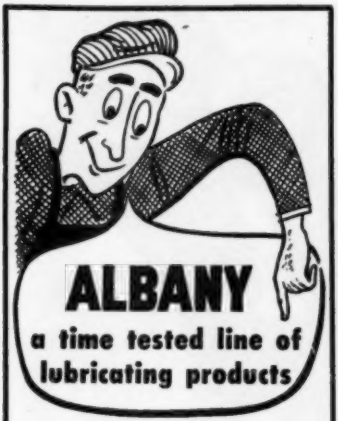

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For Cups — Ball Bearings — Water Pumps — Universal Joints. Waterproof — Exceptionally high melting point. Soft enough for gun application.

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A cooling lubricant for operating temperatures from 110° F to 200° F.

ALBANY PRESSUREGREASE
A superior waterproof mineral oil grease of high viscosity. Comes in Liquid, Soft, Medium, Hard and Graphite Pressuregrease Soft and Medium.

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Will not separate or oxidize assuring long life to bearings. May be used in hand grease guns.

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Retards wear, quiets gears. Waterproof. Will not drip when gears are idle or in motion.

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Mfrs. of Albany Lubricating Products
LINDEN, NEW JERSEY

New bulletins and catalogs

(Continued from page 166)

Distribution Systems **226**
Heavy duty trolley busway distribution systems are the subject of 16-page brochure 30. The units, which provide a movable source of power for long runs of moving electrical loads, are rated 250, 375 or 500 amp, 250 v d-c or 575 v a-c, single or three phase. Design and construction features, accessories, installation and specifications are discussed. Feedrail Corp.

Precision Switches **227**
Descriptions, specifications and technical data for precision switches, designed primarily for control of a-c circuits, are contained in 24-page catalog 82. Limit, enclosed, explosion proof, splash-proof, general purpose, reset and snap-action types are listed. Auxiliary actuators also are described. Micro Switch Div., Minneapolis-Honeywell Regulator Co.

Multi-Purpose Cable **228**
Specifications for multi-purpose cable are tabulated in 4-page folder RR-1. The cable, which features heat and moisture resistant insulation plus a Neoprene sheath, can be installed aerially, in ducts, on open racks or by direct earth burial. Rome Cable Corp.

Selenium Rectifiers **229**
To answer the most common questions about selenium rectifiers, 4-page folder 271 employs the question and answer technique. What they are, where they are used, advantages, types, expected life and operating characteristics are a few of the subjects discussed. American Rectifier Corp.

Safety Switches **230**
Front operated safety switches with general purpose, weather resistant and raintight enclosures are featured in a 12-page bulletin. Units are described for service from 30 to 1200 amp. Operating features and design are described, and specifications are tabulated. Federal Electric Products Co.

Electrical Equipment
Series of booklets discuss electrical equipment designed for specific industries. Key numbers for requesting a particular bulletin are as follows: **231 — "Electrical Equipment for Chemical Processing," 16-page bulletin B-5656, discusses power generation, distribution and utilization. 232— "Electric Equipment for Lumber Mills," 50-page book, contains data on drives, handling systems, control systems, air handling and mill lighting. 233—"Cotton Card Drives for the Textile Industry," booklet B-4596-A, revised. 234—"Power-for-Steel," 36-page brochure B-5443, revised, discusses slip regulators, reversing hot strip mills and cold reduction mills, X-ray thickness gages and arc furnaces.** Westinghouse Electric Corp.

Electrical Wiring **235**
"Safety Mineral Insulated Wiring System," 24-page booklet, contains the history and explanation of outstanding characteristics and applications of this wiring system. The wiring is described as being made up of one or more conductors, spaced and insulated with a non-combustible mineral insulation and encased in a seamless metallic tubing. General Cable Corp.

Aluminum Bus Bars **236**
Enumerated in 4-page folder B-750 are the advantages and characteristics of aluminum as an electrical conductor. The story of how engineers adapted aluminum to electrical uses also is related. A chart comparing relative size, weight and performance of aluminum and copper in bus bars is featured. BullDog Electrical Products Co.

COMPRESSORS

Air & Gas Compressors **237**
Construction of compressors developed for applications requiring oil-free compressed air or gas is shown in 4-page folder 600. The distinctive difference in design is stated to be a steel-backed carbon cylinder liner. Units are horizontal single-stage, double-acting and horizontal double-acting, two stage types. Pennsylvania Pump and Compressor Co.

Refrigeration Compressors **238**
Hermetically sealed refrigeration compressors and condensing units are described in 8-page bulletin DB 101-160. Construction and design of units of 75 to 100 hp capacity are described. Available accessories are listed. Specifications are tabulated, and line drawings give over-all dimensions. Sturtevant Div., Westinghouse Electric Corp.

Feather Valve Compressors **239**
Heavy duty package type feather valve compressors from 75 to 350 hp are featured in 32-page booklet L-676-B1. Advantages, design and specifications are given. Controls and accessories are discussed. Worthington Corp.

Air Compressors **240**
Two stage, air-cooled radial air compressors for producing pressures of 80 to 125 psi are described in 12-page bulletin H-630-B1. Dimensions, sizes and weights of bare, base-mounted multi V-belt driven, base-mounted flexible coupled, and close coupled types are listed. Capacities and specifications together with discussion of construction features are presented. Air receivers and aftercoolers also are described. Worthington Corp.

FUELS & FIRING EQUIPMENT

Spreader Stokers **241**
Engineering data concerning spreader stokers installed to burn refuse or wood are contained in 24-page booklet 505. Photos and side elevation drawings show special features. Stationary, manual

dumping, power dumping and traveling grate installations having maximum capacities from 10,000 to 275,000 lb steam per hr are described. Detroit Stoker Co.

BOILERS & BOILER ACCESSORIES

Boiler Tube Corrosion **242**
"How You Can Avoid Boiler Tube Corrosion," 8-page reprint TR-514, outlines the various types and causes of corrosion and lists proper operating and maintenance procedures to be followed for maximum service life of boiler tubing. The article indicates that corrosion is the largest single cause for tube replacement in low pressure boilers. The Babcock & Wilcox Co., Tubular Products Div.

FANS & BLOWERS

Centrifugal Compressors **243**

Single stage centrifugal compressors from 30 to 600 hp are the subject of 12-page brochure 109. Units for pressures from 1.25 to 3.75 psi are listed for inlet volumes from 4410 to 28,700 cfm. The booklet covers functions, applications, ratings, design features, arrangements and control methods. American Blower Corp.

Fans **244**

Capacity tables, dimensions and descriptions of fans designed for specific applications are given in a series of 4-page folders: C-46P; C-46AP; C-46H; and C-46EX. Included are slow speed and load limiting types used primarily in heating, ventilating and air conditioning. A pressure blower is presented for industrial uses requiring small air quantities at high pressures. An industrial exhaust fan also is described. Bayley Blower Co.

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HYDRAULIC EQUIPMENT

Oil Temperature Control **245**

Described in folder 3M-352-20 is an automatic temperature control designed for use with hydraulic fluid cooling systems. The method of installation is described. Specifications and other cooling applications are listed. Sterling, Inc.

LUBRICANTS, LUBRICATION, OIL FILTERS & PURIFIERS

Oil Reclaimer **246**

Advantages, construction and operation of oil reclaimer and conditioning systems are described in bulletin R-275. The units are direct connected to turbine reservoir or oil tanks for continuous operation, or to dirty or clean oil tanks for batch operation. All settling tanks and pretreatment of the oil are eliminated, according to the literature. The Hilliard Corp.

Bearing Lubrication **247**

Problems of ball bearing lubrication and maintenance are discussed in 8-page folder 426, entitled "The Lubrication of Fafnir Ball Bearings." The basic reasons why lubrication is necessary and a discussion of the advantages of oil or grease are included. In addition, illustrations of bearing and housing design are shown. The Fafnir Bearing Co.

Oil Purifiers **248**

"Proven Protection Against Oil Failure" in diesels, turbines, transformers, circuit breakers, switch gear and other oil-filled equipment is the subject of an 8-page booklet. Various types of oil purification equipment are presented, including design features, advantages and specifications. Honan-Crane Corp.

MATERIALS OF CONSTRUCTION

Plastic Products **249**

Plastic, available as pipe moldings, extrusions or fabrications, is described in a booklet as possessing toughness and high impact strength without sacrificing stiffness. The formulation and processing can be varied to produce a wide range of properties. Many successful applications are listed. New York Belting and Packing Co.

(Continued on page 170)

SAVE TIME TWO WAYS

with TOLEDO SIMPACT

for all 1" to 2" threading!

Dies changed from one size to another in a few seconds. Positive, practical die setting.

ONLY ONE SET OF DIES for 4 pipe sizes.

FASTER CHANGE OF SIZES! Just push the size selector button, slip dies in proper steps, turn head slightly and die size is changed!

EXTRA RUGGED FOR EXTRA LONG LIFE... producing accurate threads.

EASY TO OPERATE... simple in design... fewer parts... light in weight.

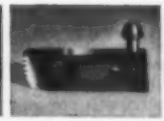
AMAZINGLY COMPACT...will thread a pipe projecting through a wall as short as 6¼".

ACCURACY THROUGH THE YEARS... dies recede along tapered steps... no cams to wear.

LOW COST! This remarkable self-contained tool assures smooth, perfectly tapered, leak-proof threads at lower cost! Play safe! Buy Toledo Simpacts at your dealer. The Toledo Pipe Threading Machine Co., Toledo, Ohio. New York Office: 165 Broadway, Room 1310.

AUTOMATIC DRIP OILING with oil pockets in head.

3-CHUCK JAWS. Easy to center, assures perfect aligned threads



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SIMPLE, COMPACT. No complicated cam parts to clog with dirt and wear.

50 YEARS OF LEADERSHIP

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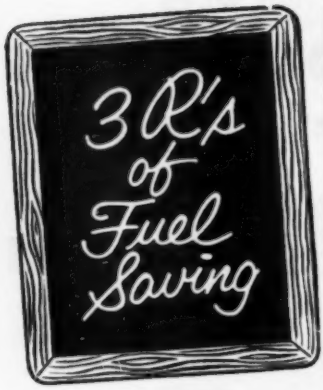
PIPE TOOLS... POWER DRIVES
... POWER PIPE MACHINES



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New bulletins and catalogs

(Continued from page 169)

Acoustic Panels **250**

Construction of standardized acoustic panels is discussed in a bulletin. How they can be used to silence noise in many applications ranging from power plant transformers to all phases of machinery is described. Industrial Acoustics Co., Inc.

Grating **251**

Published to show applications for grating in the oil refining and chemical industries, a 4-page folder describes two types of grating together with four types of stair treads. Several recently developed types are listed. Technical information includes engineers' diagrams, a safe load table for grating, and a diagram showing installation of two patented meshes for reinforcement of ganister linings. Klemp Metal Grating Corp.

MECHANICAL POWER TRANSMISSION

Speed Reducers **252**

Shaft mounted speed reducers with capacities from 1 to 43 hp are the subject of 20-page brochure A-614-A. Output speeds for the units range from 12 to 330 rpm. An overload release, developed to use with the reducers, is also featured. In addition to discussions of construction and operation, engineering information and selection data are presented. Dodge Manufacturing Corp.

Belt Drives **253**

V-belts, sheaves and adjustable speed drives are featured in 20-page bulletin WBC 7-52. Special design features such as a tapered split bushing and taper-bored hub, are described. Advantages, construction and installation also are discussed. Specifications are listed. The American Pulley Co.

V-Link Belting **254**

Facts concerning V-link belting are outlined in data book 205. Comparisons with endless V-belts and other detachable V-link belts are presented. Useful data including a selection table with power correction factors, tables of sizes and facts concerning assembly, and instructions for installation and maintenance are given. Brammer Corp.

Flexible Couplings **255**

Chain type flexible couplings are described in a 6-page folder. A straight and a diagonal type are featured. Listed in a table of dimensions are stock bores from ½ to 2½ in. with maximum bores to 5⅞ in. A table of ratings lists horsepowers to 651 and speeds to 3600 rpm. Aluminum covers for the units also are described. Ramsey Chain Co., Inc.

PACKINGS & GASKETS

Mechanical Packing **256**

Included in 20-page catalog PC-102 is an application chart which provides a quick and accurate means of determining the proper packing for a specific service condition. Data, structure and performance of self-lubricating, molded, sheet and Teflon packings are presented. Greene, Tweed & Co.

O-Rings **257**

Data of value when selecting seals for either static of dynamic applications are presented in "O-Rings . . . Design, Manufacture and Application," a 16-page booklet. The general properties of various synthetic and natural rubbers are tabulated and a discussion of basic rubbers is included. Applications are described and specifications for different types of packing are listed. Graton & Knight Co.

REFRACTORIES

Super Refractories **258**

Refractory materials providing a wide range of properties are described in 20-page booklet 5120. Properties such as corrosion and abrasion resistance, hot strength, chemical inertness and thermal conductivities are discussed. Quick reference tables aid the engineer in selecting the proper material. Refractories Div., The Carborundum Co.

SOOT BLOWERS & TUBE CLEANERS

Retractable Soot Blower **259**

Engineering details of a long retractable soot blower are outlined in 8-page bulletin 1002. Air or electric drives are listed, and either steam or air can be used as the blowing medium. How it operates and advantages are discussed. Inspection, adjustment and repair also are dealt with. Continental Foundry & Machine Co., Copes-Vulcan Div.

ENGINES

Gas Engines **260**

Totally enclosed spark ignition gas engines of 5, 6, 7 and 8 cylinders are described in 8-page bulletin S-550-B18A. Specifications and principal dimensions are listed for a four cycle unit having a 15 in. bore and a 17½ in. stroke. Brief descriptions of other models also are included. Worthington Corp.

Radial Engines **261**

Two cycle radial engines are the subject of 20-page bulletin 200. Diesel, spark-fired gas and dual fuel units rated up to 2125 hp, or 1500 kw, at 400 rpm are described. Advantages, operation, construction and applications are discussed. Nordberg Manufacturing Co.

HEAT EXCHANGER EQUIPMENT

Surface Condensers **262**

Opening with an explanation of the design, 32-page booklet B-4350 describes radial flow surface condensers. Operation and construction are fully discussed and illustrated. Accessories and testing facilities are listed, together with brief descriptions of actual installations. Westinghouse Electric Corp.

Heat Exchangers **263**

"How to Select a Heat Exchanger," is the title of a data section included in a 16-page bulletin. Design features, construction, advantages, specifications and applications of various types of heat exchangers are included. Evaporators, feedwater heaters, pressure vessels and fab-

ricated plate work, prefabricated piping and welded steel pipe are described. Alco Products Div., American Locomotive Co.

Condensers **264**

Described in 4-page folder 800 are condenser-heater-cooler units recently developed to meet the demand for low cost, junior size heat exchangers. Three types are described—coil, straight tube and pipe line. A wide range of construction materials are available for resistance to most liquids and chemicals. Manning & Lewis Engineering Co.

MOTORS & GENERATORS

Motor Controls **265**

"Industrial Motor Controls," 186-page catalog, presents information on a line of motor controls including magnetic starters, multi-speed and reversing starters, magnetic contactors and reversing contactors. Design features, weights and dimensions are included. Information on manual starters, push button stations and interchangeable control units, midget relays, limit switches and push-pull selector switches also is included. The Arrow-Hart & Hegeman Electric Co.

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Motor-Generator Sets **266**

Engineered motor-generator sets for all industries form the subject of 4-page bulletin F-2502. Briefly described are shunt or compound wound sets from ⅝ to 1000 kw—built to provide power for constant or adjustable voltage systems and engineered to include synchronous or induction motors. Typical applications show their utilization for large single motor drives, excitation of synchronous machinery, multi-motor drives, and spot conversion—an economical means of supplying d-c power at the point of use. Reliance Electric & Engineering Co.

Vertical Motors **267**

Industrial users of deep well turbine pumps will find many interesting developments in vertical motor design contained in 16-page bulletin F1454. Cutaway views, in full color, illustrate construction of vertical motors from 1½ to 400 hp. U. S. Electrical Motors, Inc.

Eddy-Current Machinery **268**

"Basic Principles of Eddy-Current Machinery," a section of 16-page bulletin GB1, explains the fundamental principles of generating torque by means of eddy-current devices. Another section, "Characteristics of Rotating Equipment," contains engineering data. Descriptions are included of typical eddy-current equipment such as adjustable speed drives, couplings, brakes, dynamometers and clutches. Dynamatic Corp.

Electric Power Drives **269**

Engineers concerned with electric drives for applications requiring variable speed, low speed or protective type enclosures should find 20-page brochure 174 a source of useful information. The booklet gives design and construction features of totally enclosed, splash-proof and drip-proof motors, as well as variable speed drives and gear motors developed to meet a considerable variety of applications. Sterling Electric Motors.

(Continued on page 172)

WITH A DART YOUR CLOSURE IS DROP-TIGHT AND YOU KNOW IT!

Dart's two bronze seats maintain tight seal as long as in service — and as often as piping is changed. They can be taken off the line and reinstalled *over and over again!* They're made of non-corrosive bronze for greatest protection against corrosion and pitting.

Yes, and because a Dart's precision ground to a perfect sphere, the tight seal comes easily and stays tight without heavy wrenching or fuss.

Ends and nut of a Dart are practically indestructible — they're made of high test air refined malleable iron. Stress, stretching and wrench abuse are no problems with a Dart.

Specify Dart Unions. You'll get maximum possible work life, drop tight closures, repeat use and easier installing — ALL IN ONE "PACKAGE".

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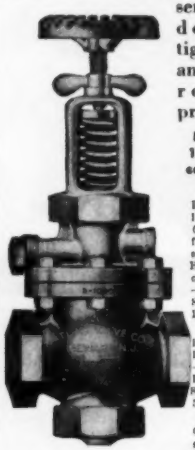
DART UNIONS

ATLAS STELLITED STEAM REDUCING VALVES

Type "B"

ATLAS TYPE "B," always a remarkable performer, is now a *much better* performer because it is STELLITED. The Pilot Valve is made entirely of that famous metal. The seat is STELLITE faced.

Try a Type "B" and you will find that it is unequaled for a service that demands tight seating and uniform reduced pressure.



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Here we show Fig. 112 of Bulletin No. 1-A (Ask for a copy) for 300 lb. steam service. All Bronze—Screwed or Flanged Ends—Pilot Operated. Sizes: ½"-¾"-1"-1¼"-1½"-2".

For 250 lb. service we offer Fig. 114. Iron Body—Flanged Ends—Pilot operated. Sizes: 2½"-3"-4"-5"-6"-8".

And for 400 and 600 lb. service see page 10 of Bulletin 1-A.

These valves are for temperatures to 900° F. Steel Body—Nitralloy Piston and Stainless Steel Piston Chamber—Flanged Ends—Pilot Operated. Sizes: ½", ¾", 1", 1¼", 1½", 2", 2½", 3", 4".

Type "B" is simple to maintain. Main valve disc and pilot valve are easily removed for cleaning or regrinding. The entire pilot valve can be lifted out by merely removing diaphragm and unscrewing pilot valve seat.

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	☐ Control Valves

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New bulletins and catalogs

(Continued from page 171)

PIPE, TUBING & HOSE

Industrial Hose **270**

Application, selection and installation of industrial hose assemblies, couplings, stems, swivels and accessories are described in 24-page catalog 52. According to the literature, the hose is designed for a broad range of industrial applications, including high pressures and temperatures and excessive flexing. J. N. Fauver Co.

Flexible Metal Hose **271**

Quick reference catalog CC-400, 16 pages, contains brief descriptions of seamless and strip wound flexible metal hose and tubing. Specifications for fittings also are presented. Materials of construction, suggested applications and engineering data are listed in tables. American Metal Hose Branch, The American Brass Co.

Flexible Metal Hose **272**

Catalog CMH-130, 32 pages, lists many styles of flexible metal hose, including corrugated and stainless steel types. Descriptions, specifications and applications are given. Also covered are coupled types, special assemblies and installation information. Flexonics Corp.

Industrial Hose **273**

Five basic types of color coded multipurpose industrial hose, developed to replace 18 types formerly offered, are described in 8-page bulletin 3680. The publication gives details of construction, sizes, pressures, recommended couplings and uses. Thermoid Co.

Fabricated Fittings **274**

Published to serve as an aid in planning pipe and equipment layouts, 4-page folder 525 describes various standard and special fabricated fittings. Specifications and prints are given on standard units for light weight pipe. Illustrations of special fabrications are shown to suggest possible applications. Naylor Pipe Co.

STEAM SPECIALTIES

Steam Traps **275**

"How to Calculate Volume of Condensate," a section of 12-page bulletin 213, revised, should be of interest to engineers working with steam traps. An explanation of the inverted bucket principle and a capacity chart will also be of value. Data on cast semi-steel and forged steel steam traps, ball float air traps and air relief traps are included. Internal check valves, blast traps with thermic vents, traps with built-in strainers and Y-type strainers also are described. Armstrong Machine Works.

TOOLS

Tube Expanding Tool **276**

"Tube Rolling," a 4-page folder, discusses a controlled method of expanding and rolling tubes into tubesheets. The literature states that the method is performed by an automatic machine driving the tube-expanding tool. Vernon Tool Co., Ltd.

Hydraulic Conversion Unit **277**

Described in 12-page bulletin 97-108A is a unit for converting the company's pulling sets to hydraulically powered systems. Suggested uses, methods of application, advantages and specifications are outlined. In addition to puller sets, the unit can be adapted to such equipment as jack screws, bench presses, pedestal presses and sleeve puller units. Owatonna Tool Co.

THERMAL INSULATION

Industrial Insulations **278**

Industrial insulation products are the subject of 20-page catalog J-1, Rev. Insulating products including cement, block, blanket, felt and pipe covering, which cover a temperature range from -150 to 1800 F, are described. Descriptions of applications together with typical uses, sizes, packages and densities are a part of the publication. Useful data, including thermal conductivity graphs and heat loss charts, are presented. Baldwin-Hill Co.

TRANSFORMERS

Air Cooled Transformers **279**

Construction, specifications and applications of various sizes and types of dry type transformers are outlined in 8-page bulletin 748A. Applications also are described. Units ranging from ¼ kva, single phase to 2000 kva, three phase are shown. Several transformers designed for special applications also are presented. Sorgel Electric Co.

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Dry Type Transformers **280**

General construction, specifications and descriptions of dry type transformers for industrial control are presented in 8-page bulletin T-5111. Engineering data are listed in the form of graphs, tables and diagrams. Special transformers such as motor starting reactors and auto transformers also are described. Hevi Duty Electric Co.

VALVES

Gate Valves **281**

Details of design, specifications, pressure and temperature ratings, and dimensions of cast steel gate valves are presented in 6-page folder 12-E. Valves cataloged include 300, 600, 900 and 1500 lb classes. All are listed in sizes from 2½ through 12 in. with flanged or welded ends. Edward Valves, Inc.

Heating Specialties **282**

How to design a one-pipe hot water system is explained in 8-page booklet J-355. In addition to discussions, data tables and diagrams are included. Many types of heating specialties are described, including a circulator, flow valves and fittings, relief valves, vents, a charging valve and compression tank. The Trane Co.

WATER TREATMENT

Filters **283**

Described in a 22-page brochure are several types of sand filters, including vertical and horizontal pressure types and a horizontal multiple-cell type. Advantages, operation, specifications and information on how to size are included. Refinite Sales Co., Div. of The Refinite Corp.

Purity Meter **284**

"How Pure Is Your Distilled Water?", pamphlet 125, describes a recently de-

veloped electronic testing device for determining purity of distilled or demineralized water. How it operates, how it is used, and specifications are outlined. Accessories are listed. Also described is an automatic conductivity diverter which permits only water of a predetermined purity to enter a storage tank. Barnstead Still & Sterilizer Co.

Waste Treatment **285**

"Industrial Waste Treatment Guide," 8-page bulletin B-I-F 4, contains a highly useful table showing the different types or combinations of unit treatment processes for more than 50 wastes. Other tables show equipment used in several unit treatment processes. A flow diagram shows how various treatment processes and equipment may be combined to treat mixed wastes. Builders-Providence, Inc.

Boiler Water Treatment **286**

Difficulties caused through industrial water contamination are outlined in a 12-page catalog. Recommended water conditioning treatments for scale, sludge, corrosion, carryover and other boiler conditions, and efficient control methods are described. Details on a system of complete boiler water conditioning are fully explained. E. F. Drew & Co., Inc.

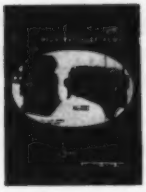
PACKAGED STEAM GENERATORS

Water Tube Boilers **287**

Construction and design features of 2-drum water tube boilers with integral water wall elements are described in 20-page brochure SB43. Factory assembled units, up to 300 hp, are described for underfeed stoker, spreader stoker, oil or gas firing. Larger units for field erection also are discussed. Actual installations are presented. Erie City Iron Works.

Packaged Steam Generator **288**

Facts concerning construction and operation of a shop assembled water tube boiler are presented in 6-page folder B-3275. Front and side elevation drawings give dimensions. Burners can be supplied for most types of oil and gas, or for combination oil and gas. Capacities are 7500 to 27,500 lb per hr. The Titusville Iron Works Co., Div. of Struthers Wells Corp.



PUMPS

High Pressure Pumps **289**

Construction features of direct drive and back geared high pressure pumps are shown in cutaway views contained in 6-page folder 295. In addition to hydraulic machinery, applications such as high pressure boiler feeding and testing and back washing of pipes, valves and vessels are listed. Specifications are discussed and tables list capacities of 1.1 to 16.5 gpm for pressures of 600 to 5000 psi. American-Marsh Pumps, Inc.

Chemical Transfer Pump **290**

Described in 6-page folder B-1606 is a semi-open impeller centrifugal pump for

(Continued on page 174)

AJAX
Spiralwound Gaskets
Breathe with varying
Pipeline Stress

"spring-loaded"

How much "give" to a dead piece of metal? How much bounce to the ounce of asbestos? Very little!

But with Spiralwound, a "spring-loaded" preformed metal strip with an asbestos filler, you have a gasket that breathes with varying pipeline or boiler stresses. "The Spring is the Thing." It keeps joints tight at low bolt loads, seals irregular, pitted or warped surfaces, has enough resiliency, usually, to be used over again if the joint must be parted.

Get the spring-loaded multiple knife edge contacts of these gaskets to insure safe seals, always. Write for catalog or ask your favorite industrial distributor about them.

UNITED STATES GASKET COMPANY

FABRICATORS OF "TEFLON" & "KEL-F" FOR THE CHEMICAL PROCESS & ELECTRONIC INDUSTRIES
CAMDEN 1 NEW JERSEY

Your CHIMNEY can improve plant efficiency — save money

Much depends upon the size and construction of your chimney. Improper draft can waste fuel, reduce power and cause endless trouble. Old chimneys with eroded linings and cracks or spalled areas are equally wasteful.

With production costs at an all-time high and plant efficiency an absolute necessity, it might be well to check your chimney. Phone, wire, or write and a Consolidated Engineer will inspect your chimney at no inconvenience to you and make whatever recommendations are necessary.

This service places you under no obligation.

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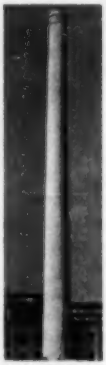
Linings —
Waterproofing —
Repairs —
Aircraft Warnings —
Lightning Rods —
Demolition



250 ft. x 12 ft. Reinforced Concrete Chimney designed and built for Amalgamated Sugar Co., Nyssa, Ore.

CONSOLIDATED CHIMNEY CO.
Engineers and Builders
6 South Dearborn St., Chicago 3, Ill.

New bulletins and catalogs

(Continued from page 173)

continuous or intermittent light duty in transferring process chemicals. Construction and advantages are described. Capacity, listed in a specifications table, ranges from 10 to 250 gpm for heads of 10 to 140 ft and temperatures to 250 F. A unit for higher pressures, temperatures and capacities also is described. Food Machinery and Chemical Corp., Peerless Pump Div.

Centrifugal Pumps 291

Centrifugal pumps applicable to most industries are highlighted in 12-page bulletin 52C6059J, entitled "Handy Guide to Selection of Centrifugal Pumps." In addition to describing general purpose, double suction, multi-stage, special purpose, marine, mixed flow and axial flow pumps, the bulletin contains a head-capacity table for single stage, double suction units. Special purpose pumps include solids handling, paper stock, sewage, rubber-lined, process, fractional horsepower, coolant and circulating units. Allis-Chalmers Manufacturing Co.

Proportioning Pumps 292

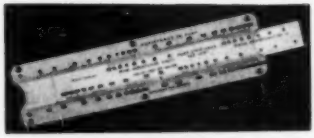
Heavy duty chemical proportioning pumps are the subject of 8-page bulletin 1225. Furnished as self-contained units, they have one, two or three measuring chambers for capacities to 57 gph. The bulletin gives specifications and features together with installation diagrams, applications and operating data. %Proportioneers, Inc.%

Rotary Pumps 293

Installation, operation and maintenance of rotary pumps are covered in 12-page service manual 100-2. Subjects discussed include installing foundation bolts, alignment, supporting vertical pumps, grouting, piping, suction lines, hot liquid pumps, rotation, packing, dismantling, reassembly, starting, operation and standing idle; also various charts and sectional elevation drawings. Warren Steam Pump Co., Inc.

Pump Calculator 294

Slide rule calculator, made of plastic, shows at a glance the horsepower required for any given pump efficiency, if gal-



lons per minute and head in feet of water are known. Peerless Pump Div., Food Machinery and Chemical Corp.

Centrifugal Pump 295

Seals and stuffing boxes are eliminated in a recently developed centrifugal pump described in a 4-page folder. A large cutaway view shows construction details. Many advantages gained by the new design are outlined. According to the bulletin, the unit will handle any clear liquid and many slurries. Chempump Corp.

Centrifugal Pumps 296

General purpose, cradle-mounted centrifugal pumps are the subject of 16-page brochure 7223. Five basic cradle groups

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and 17 corresponding pump types are presented. Capacities of 5 to 2400 gpm are listed for pressures of 10 to 300 ft total head. Dimensions, applications and a table of performance are included. In addition, special purpose units and design modifications are described. Ingersoll-Rand Co.

Centrifugal Pumps 297

Integral construction of pump and motor is featured in the design of a close coupled centrifugal pump described in 8-page brochure 200-B. Advantages are discussed. Mounting in any position is possible, according to the bulletin. A selection table lists capacities of 30 to 110 gpm with heads of 110 to 200 ft. Dimensions are tabulated. Useful tables listing friction of water in pipes and fittings also are presented. Carver Pump Co.

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Heat Treatment 298

Heat-treating equipment is the subject of 28-page catalog No. 52. Illustrating the containers, fixtures and retorts more commonly used in carburizing and annealing, the publication also contains installation views of new equipment which has interesting possibilities for reducing handling and heating time. Various types of tubing for annealing, firing radiant furnaces, venting noxious gases and protecting thermocouples also are described. The Pressed Steel Co.

Electric Power Drives 299

"Motor-Drive Is More Than Power," 4-page folder A-2703, is intended to serve as an introduction to the company's principal products. Included are brief descriptions of a-c motors from ¾ to 300 hp; heavy duty d-c motors from ¾ to 1000 hp; all-electric adjustable speed drives for a-c circuits, from ¾ to 300 hp, and electronic controls and regulators for this motor-drive system; and motor-generator sets, generators, and rotating type regulators. Reliance Electric & Engineering Co.

Reviews of EXTERNAL HOUSE ORGANS

For a regular copy of a particular house organ, write direct to company

Beckman Bulletin

Discussions of many types of industrial instruments are contained in this 8-page quarterly publication. New developments and bulletins also are listed. Titles of a few of the articles appearing in issue No. 9 are: "Theory and Design of the H-F Conductometer"; "Automatic pH Control Prevents Scaling in Heat Exchanger"; and "Automatic pH Control Governs Taste and Flavor of Beer." Beckman Instruments, Inc., South Pasadena 3, Calif.

Climate Chart

Air conditioning and refrigeration installations are described in feature articles of a quarterly house organ. Vol. 4, No. 2, 16 pages, contains an article, "Air Conditioning Adds to Manhattan's Magic," describing installations in many well known buildings. Stories describing refrigeration installations also are included. Particularly useful is a department entitled "Service Hints." Air Conditioning and Refrigeration Div., Worthington Corp., Holyoke, Mass.

The Manifold

October, 1952 is the first issue of a monthly publication discussing applications of chemical cleaning in power and industry. Each issue will contain an article describing general procedure for cleaning a specific type of equipment. Various types of cleaning for boilers are discussed in 4-page Vol. 1, No. 1. At least one column will be devoted to a Question and Answer section, featuring questions submitted by the readers concerning specific cleaning problems or related subjects. Sumco Engineering Co., 144 Centre St., Brooklyn 31, N.Y.

Valve Topics

This 4-page publication is edited expressly for users of stainless steel valves and fittings. Each month an article features a specific industry, describing various service conditions to which valves are subjected. The latest issue tells the story of Texas Eastman Co. Technical topics such as "Getting the Most Out of Your Valves," also are included. The Cooper Alloy Foundry Co., Hillside, N. J.

Chromalox News

Applications of electric heat in industry are dealt with in a 4-page publication. Articles in issue No. 48 describe electric heat in sidewalks for snow removal, electric heat applied to a new shell molding process, portable heating units and electric preheating and controlled cooling to improve weld quality. A technical article, "Contact Is Important for Best Results in Surface Heating," gives useful information. Edwin L. Wiegland Co., 7300 Thomas Blvd., Pittsburgh 8, Pa.

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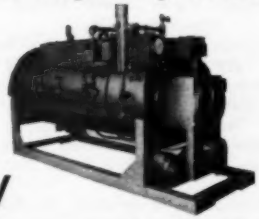

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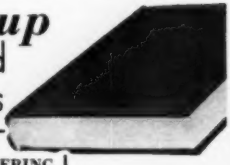

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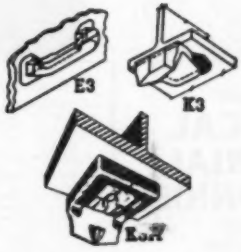

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There is a Mercoid DA Pressure Control for your particular application in pressures varying from 30" vacuum to 2,500 p.s.i. (available in many different circuit arrangements).

Apart from bourdon tube operated pressure controls, Mercoid offers a line of bellows and diaphragm actuated controls.

Explosion-proof and weather-proof cases are adaptable to practically all series.

If you have an automatic control problem involving the control of pressure, temperature, liquid level or mechanical movement, write for Catalog No. 700A.

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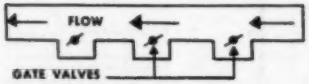
CANTON STOKERS

flo-tubes

WHEN COAL GOES UP THIS WAY . . . LABOR COSTS COME DOWN

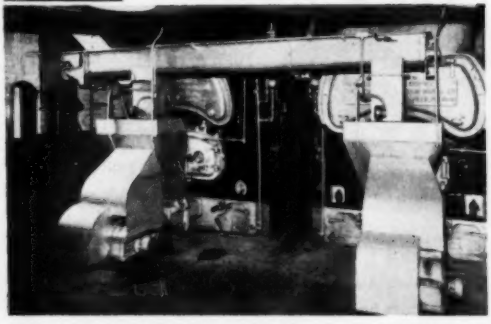
Rising costs, going higher, have speeded up the need for automatic handling of coal —the lowest priced fuel. It will pay to look into the new developments by Canton Stoker, specialists in COAL FIRING, HANDLING, and CONTROL equipment.



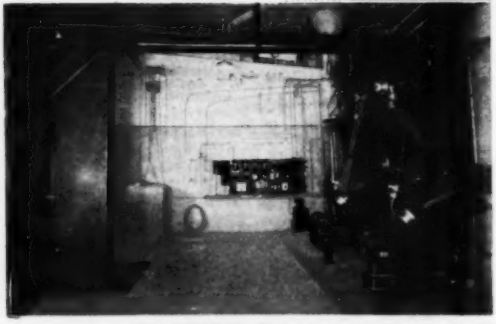
FEEDING THREE OR MORE HOPPERS: The horizontal crossfeed unit is designed to convey coal to a battery of hoppers; receives its fuel by transfer from any type of inclined or vertical Conveyor.

FEEDING ONE OR TWO HOPPERS: This design conveys coal from the coal bin or pile on an inclined plane to feed one hopper or with 'Y' assembly to feed two hoppers.

CANTON "FLO-TUBE" COAL CONVEYOR SET UP ON FACTORY TEST FLOOR BEFORE SHIPMENT, SHOWING APPLICATION TO CANTON STOKERS DESIGNED FOR PACKAGE TYPE WATER TUBE BOILERS. THIS IDEAL INSTALLATION INCLUDED CANTON SYNCHRONIZED COMBUSTION CONTROL, CANTON "TURBO-AIRE" SMOKE CONTROL, TWO CANTON LO-SET RAMFEED STOKERS HOPPER FILLED BY CANTON FLO-TUBE FROM COAL BIN. STARTS AUTOMATICALLY AT LOW COAL LEVEL IN HOPPER . . . FILLS BOTH HOPPERS UNTIL DESIRED HIGH LEVEL IN HOPPERS IS REACHED.



INSTALLATION AT A LARGE BAKERY IN PENNSYLVANIA. CANTON LO-SET RAMFEED STOKERS FOR ANTHRACITE COAL INSTALLED UNDER STEEL FIREBOX POWER BOILERS, INCLUDING BIN-TO-HOPPER COAL CONVEYOR AUTOMATICALLY CONTROLLED, PLUS CANTON COMBUSTION CONTROLS.



THIS EFFICIENT LAYOUT FEATURING CANTON STOKERS AMPLY FULFILLS EVERY HEAT AND POWER DEMAND OF A HUGE FURNITURE WAREHOUSE AND SALESROOM IN MICHIGAN. COAL ELEVATOR AT LEFT, FLO-TUBE DIRECTLY OVERHEAD.

CANTON STOKERS

CANTON STOKER CORPORATION

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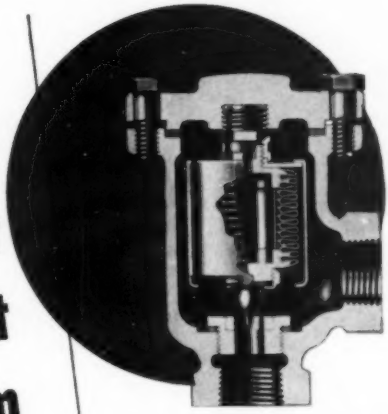
REPRESENTATIVES IN PRINCIPAL CITIES — OR WRITE DIRECT FOR COMPLETE INFORMATION ON: FLO-TUBE SYSTEMS; BINFEED STOKERS; TURBO-AIRE SMOKE CONTROLS AND ALL MODELS OF CANTON STOKERS.

"you can't beat them for PROCESS EQUIPMENT"



Sarco Balanced Pressure Thermostatic Steam Trap No. 9, available in sizes ½" to 2" for pressures to 300 psi. Ideal for individual trapping of process equipment.

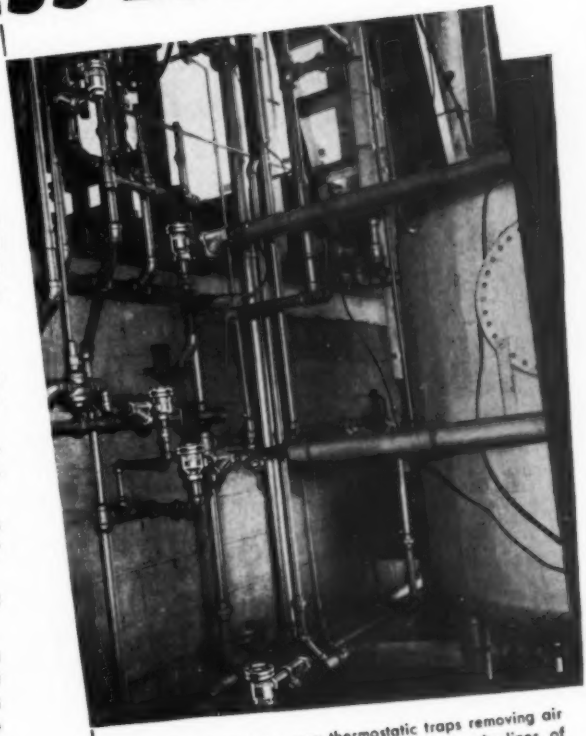
. . . says Mr. Paul H. Todd, owner of Farmers' Chemical Laboratories, Kalamazoo, Mich.

● Mr. Todd has reference to the Sarco Balanced Pressure Thermostatic Steam Traps used throughout his efficient plant, equipped with the finest of modern processing machinery.

He selected Sarco No. 9 because:

1. Highest capacity per dollar cost.
2. The large discharge valve is wide open when the trap is cold, assuring rapid air venting for quick starts from cold.
3. Small size, low first cost and minimum maintenance make them ideal for individual trapping (a trap on every coil).
4. No adjustments or valve and seat changes are necessary when pressures change. Fewer spare parts to stock.
5. Requires no special protection against freeze-ups when installed outdoors.

For full information write for free Bulletin 250-14 to Sarco Company, Inc., Empire State Bldg., New York 1, N. Y., Represented in principal cities. Sarco Canada Ltd., Toronto 8, Ont.



Sarco balanced pressure thermostatic traps removing air and condensate from steam coils and supply lines of large vacuum still with reflux column and condenser at plant of Farmers' Chemical Laboratories, Kalamazoo, Mich.

SARCO saves steam

improves product quality and output

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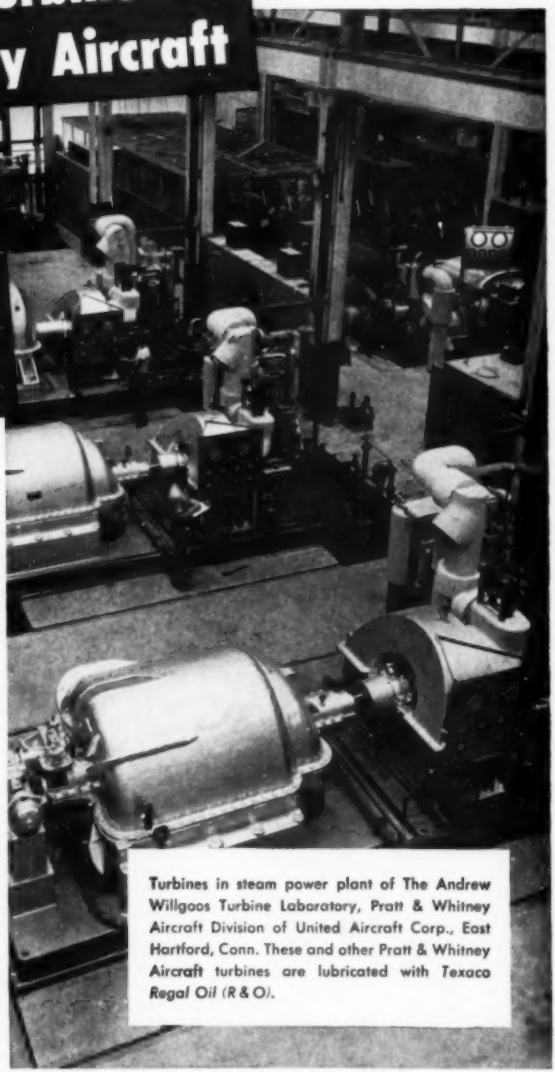

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